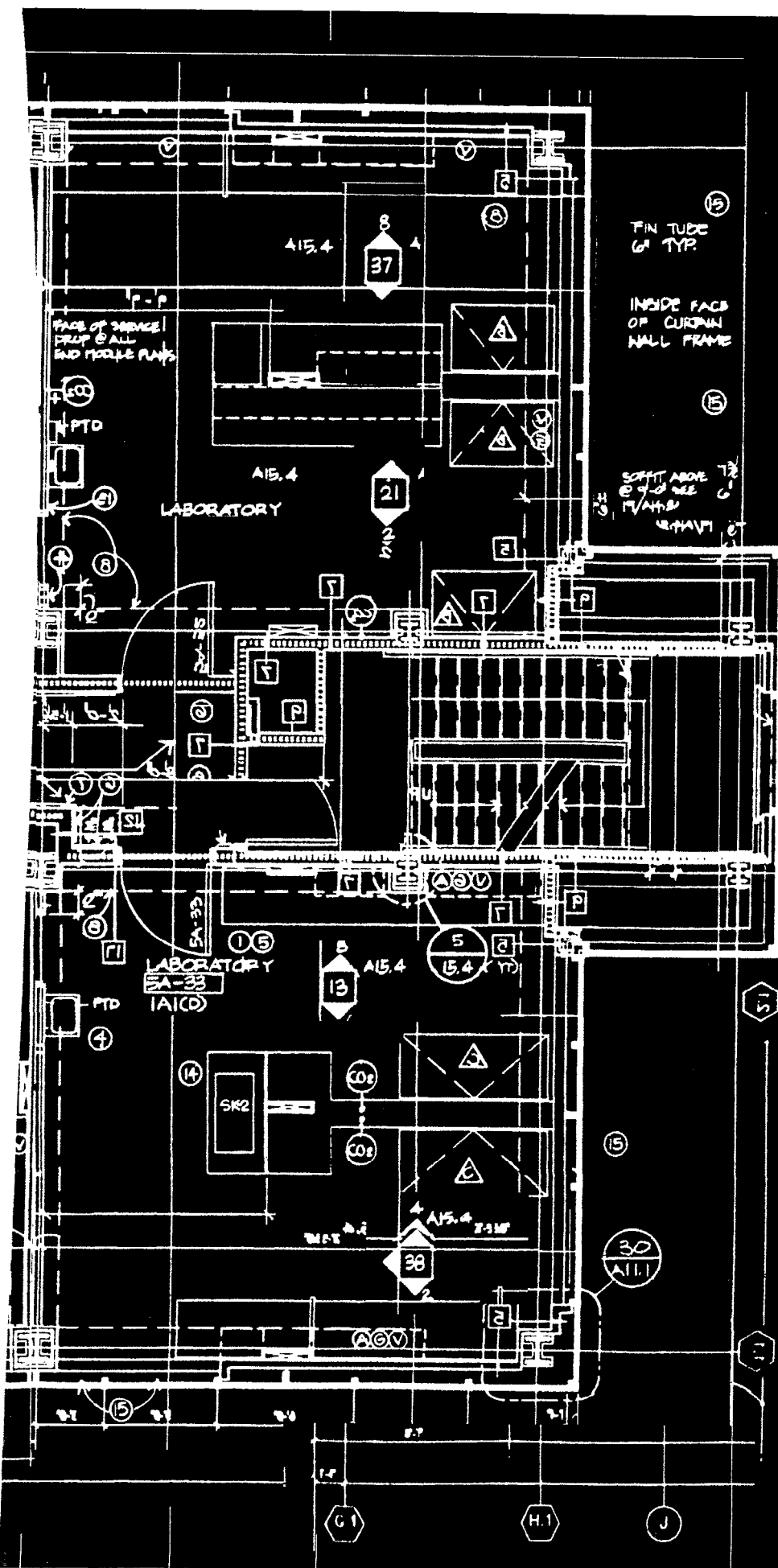


The Status of Biomedical Research Facilities 1996



The Status of Biomedical Research Facilities 1996

Prepared by the
Office of Science Policy
and Technology Transfer
National Institutes of Health

U.S. DEPARTMENT OF HEALTH
AND HUMAN SERVICES
Public Health Service
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For Administrative Use Only

Highlights

Since 1986 and every two years subsequently!, the National Science Foundation (NSF) and the National Institutes of Health (NIH) have collected data on the amount and quality of science and engineering research space, the extent to which universities, colleges, hospitals, and nonprofit research organizations were constructing new facilities and repairing existing space, and the funding of this activity. The findings highlighted below focus on biomedical research facilities — those located in the biological and medical sciences — and summarize those in the report, *The Status of Biomedical Research Facilities: 1996*.

- In 1996, institutions performing biomedical research devoted a total of 67.4 million net assignable square feet (NASF) to this research. The biological sciences occupied 53 percent of the total biomedical research NASF (35.9 million NASF) and the medical sciences occupied 47 percent of this space (31.5 million NASF).
- Forty-seven percent of all biomedical research-performing institutions classified the amount of biological science research space as inadequate, and 51 percent indicated that they had an inadequate amount of medical science research space. Forty-five percent of the biomedical research space at research-performing institutions was considered “suitable for use in the most scientifically competitive research.”
- In fiscal years 1994-1995, expenditures on projects to construct biomedical research space totaled \$1,521 million, a decline of \$723 million in constant dollars (adjusted for inflation) from the previous two fiscal years.
- Expenditures on projects to repair/renovate biomedical research space also declined from fiscal years 1992-1993, from \$710 million to \$674 million (in constant dollars).
- The largest proportion, 35 percent, of new construction was funded by state and local governments. Institutions used their own funds to finance 46 percent of all repair/renovation projects.
- In 1996, 36 percent of all institutions with biomedical research space reported capital projects, either construction or repair/renovation, that were needed but had to be deferred because funds were not available. The estimated cost for deferred biomedical research construction and repair/renovation projects totaled \$4.1 billion.
- In 1996, the 68 research-performing Historically Black Colleges and Universities (HBCUs) contained 2.4 million NASF of S&E research space; 29 percent of this space was designated for biomedical research. Sixty-seven percent of biomedical research space located in HBCUs was dedicated to the biological sciences and 33 percent to medical sciences. Five HBCUs started construction projects, totalling \$685,000 in fiscal years 1994-1995. Repair/renovation projects totalled \$6.9 million in that same time period.

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Administrators at the higher education associations and societies who reviewed and commented on the report included:

- Marvin E. Ebel, Council on Governmental Relations (COGR)
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The 1996 survey was conducted by The Gallup Organization of Rockville, Maryland, under contract to NSF (Contract Number SRS-9317363). Gregory Gaertner served as Gallup's overall Project Director; Jennifer Spielvogel led field operations; Manas Chattopadhyay was the project statistician; and Yonghe Yang directed the data processing for the survey. Alison Cooper and Betty Garrison managed the production of the report.

Subcontractors for the project were Pelavin Research Institute (PRI) and the American Institutes for Research (AIR). Rita Kirshstein headed the Pelavin team, Susan Kleimann directed the AIR contributors, and Ray Varisco edited the report.

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Executive Summary

Biomedical research facilities are a critical component of the nation's science and engineering (S&E) research system. The availability and condition of biomedical research space directly affect the scope and quality of the biomedical research conducted at the nation's colleges, universities, medical schools, hospitals, and other research organizations. Numerous Congressional committees have expressed concerns about the quality of S&E facilities and the costs of maintaining them. Hearings held in both House and Senate committees on science and technology in the mid-1980s led to the conclusion that the condition of research facilities posed a "serious and ongoing problem. ..."

To address the need for information on the amount and quality of research space, Congress mandated that the National Science Foundation (NSF) gather this information and report it to Congress. Since 1986, NSF and the National Institutes of Health (NIH) have collected data on a biennial basis to address Congressional concerns. The first study, a "quick response" survey, provided limited data regarding biomedical facilities issues. In 1988, 1990, 1992, 1994, and 1996, full scale surveys provided considerable information about the nation's academic research facilities.

This report describes the findings from the 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities (Facilities survey) and places them in historical context by comparing results with those from earlier surveys. Following a brief discussion of the study methods, the remainder of this executive summary presents the findings from the 1996 Facilities survey about the availability and condition of this nation's biomedical research facilities.

Methods

The college/university sample for the 1996 Facilities survey represents a universe of approximately 560 institutions. This universe includes all colleges and universities with research and development expenditures of \$50,000 or more as well as Historically Black Colleges and Universities with any R&D expenditures.¹ In addition, a sample of hospitals, medical schools and nonprofit research organizations that received extramural research funding for biomedical research from NIH in fiscal year 1992 were also included in the study.

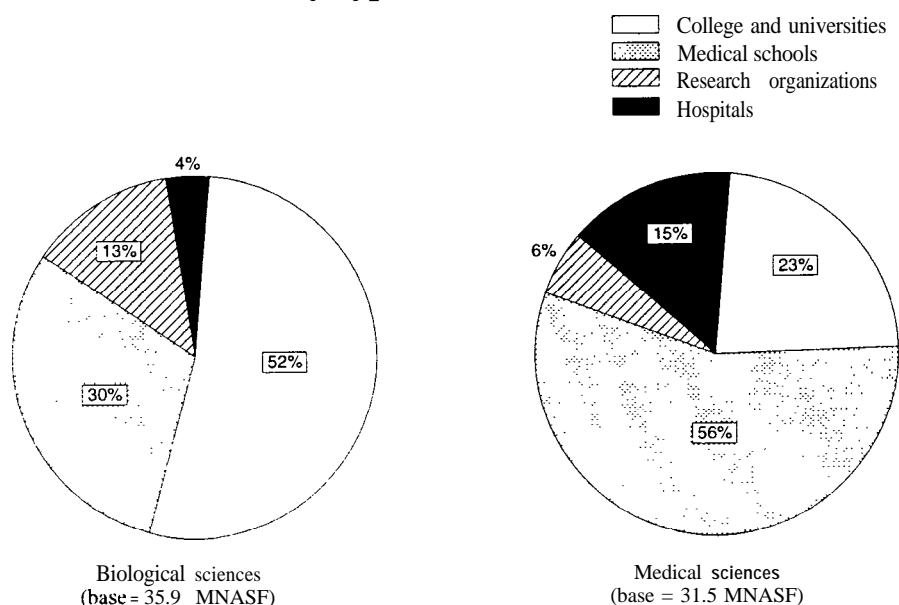
The 1996 survey was mailed to all sampled institutions in the fall of 1995. Extensive telephone follow-up was used to elicit a 93 percent response rate and to resolve questions regarding incomplete or inconsistent responses. Sampled institutions that participated in the 1994 survey were also sent a computer generated "facsimile" of their previous responses. (See Appendix A, Technical Notes, for a detailed description of the sampling procedures and data collection methods.)

¹ The first two cycles of the survey, 1986 and 1988, included only 29 HBCUs. Based on additional information not available when the first two surveys were conducted, the sample for the 1992 and 1994 studies were expanded to represent an enlarged group of 70 research-performing HBCUs.

Amount of Research Facilities Space

In 1996, institutions performing biomedical research devoted about 67.4 million net assignable square feet (NASF) to this research.² This figure represents continuing growth in the amount of biomedical space — from 51.9 million NASF in 1988 to 62.5 million NASF in 1994 to 67.4 million in 1996. Of the 67.4 million NASF, 35.9 million NASF was devoted to research in the biological sciences, and 31.5 million NASF was devoted to research in the medical sciences. Forty-two percent of all biomedical research space was located in medical schools, while 39 percent was located in colleges and universities. Of the biomedical research space, 56 percent of medical science research space was located at medical schools (Chart ES-1). Fifty-two percent of biological science research space was located at colleges and universities.

Chart ES-1
Distribution of biomedical research space in biological and medical sciences, by type of institution: 1996



KEY: MNASF = Net assignable square feet in millions

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities*. 1996. Bethesda, MD, 1997

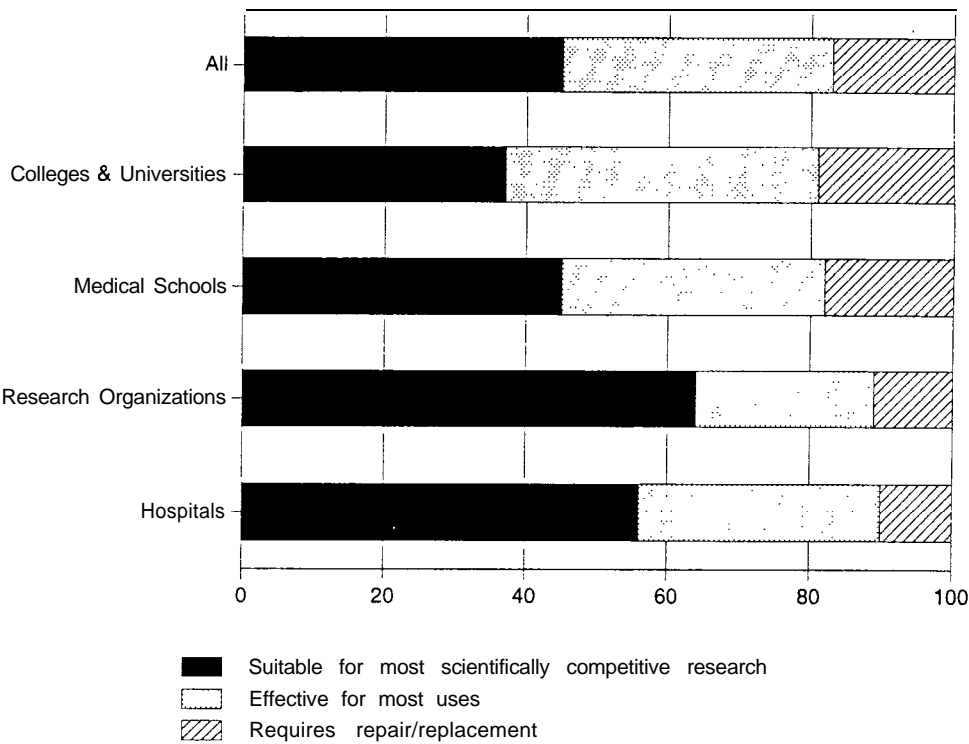
² Throughout this report, research is defined as “all research and development activities of an institution that are budgeted and accounted for.” Research can be funded by the Federal government, state governments, foundations, corporations, universities, or other sources. “Research space” refers to the net assignable square footage of space within research facilities (buildings) in which research activities take place. Multipurpose space, such as an office, is prorated to reflect the proportion of use devoted to research activity.

Adequacy and Condition of Research Facilities Space

A large proportion of survey respondents indicated that the biomedical research space available to them in 1996 was inadequate and not sufficient to support the needs of their research. In fact, over half of the institutions, 51 percent, classified their medical science research space and 47 percent classified their biological science research space as inadequate.

Of the 67.4 million NASF of biomedical research space available in 1996, 11.5 million NASF (17 percent) needed either major repair or renovation or needed replacement (Chart ES-2). Approximately 45 percent of all biomedical research space was rated as suitable for use in the most scientifically competitive research. This proportion decreased for colleges and universities; which rated 37 percent of their biomedical space as suitable for competitive research.

Chart ES-2
Condition of biomedical research facilities,
by institution type: 1996



NOTE: Because of rounding, components may not add to 100.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities: 1994*, Bethesda, MD, 1996

Construction and Repair of Research Facilities

In fiscal years 1994-1995, institutions spent \$1,521 million to construct new biomedical research space. This amount represented a decline of \$723 million in constant dollars from the two previous fiscal years and the first decline in construction expenditures since NSF and NIH began collecting data on biomedical research facilities.

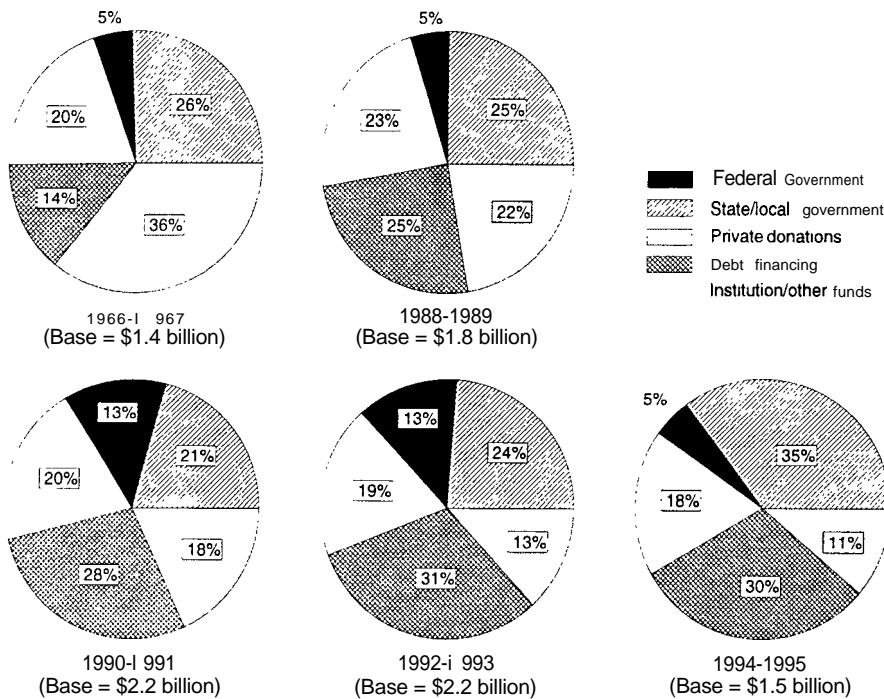
During the same time period, institutions spent \$674 million to repair/renovate biomedical research space. This amount also represented a decline in expenditures from the previous two fiscal years and only a slight increase, in constant dollars, since 1986-1987.

Funding of Research Facilities Projects

Of the \$1,521 million spent on new construction of biomedical research facilities in fiscal years 1994-1995, state and local governments provided 35 percent of the funds and institutions funded 30 percent with debt financing (Chart ES-3). This represented the largest percentage contribution from state and local governments of any survey year. In fiscal years 1986-1987, private donations represented the primary source of construction funding — 36 percent. Over time, funding from the Federal government increased from 5 percent to 13 percent between the 1986-1987 and 1992-1993 fiscal years and declined once again to 5 percent in 1994-1995.

Institutional funds represented the largest contribution to the repair/renovation of biomedical research space in 1994-1995, 46 percent. Eight percent of all repair/renovation funding of biomedical research space was provided by the Federal government in that same year.

Chart ES-3
Sources of funds for construction of
biomedical research facilities: 1986-1995¹



¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only. Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

NOTE: Because of rounding, components may not add to 100.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities*: 1994, Bethesda, MD, 1997

Deferred Construction and Repair/Renovation

Since its inception in 1988, the *Survey of Scientific and Engineering Research Facilities at Colleges and Universities* has provided considerable data on the amount, condition, and capital project activity in our nation's research-performing institutions. An equally important issue, and a concern to policy makers, is the amount of additional S&E research space needed as well as the cost to repair/renovate existing S&E research facilities.

The 1996 survey asked respondents to report deferred construction and repair/renovation costs that related to current S&E research program commitments. Several other limits were placed on respondents to avoid "wish list" types of estimates (See Item 7 of the survey in Appendix B). IN 1996, 36 percent of all institutions with biomedical research space reported construction or repair/renovation projects that were needed but had to be deferred because funds were not available. The total estimated cost for deferred biomedical research construction and repair/renovation projects in 1996 was \$4.1 million.

Research Facilities Space at Historically Black Colleges and Universities

Historically Black Colleges and Universities (HBCUs) have played an important role in the education of black students at all higher education levels for over 100 years. These universities and colleges consist of both public and private institutions as well as two-year, four-year, and professional schools. In 1991, approximately 269,000 students attended the 105 institutions of higher education considered HBCUs by the U.S. Department of Education. Although the HBCUs have considerably less biomedical research space than other research-performing institutions, the HBCUs are an important source of science degrees for the black students who are currently enrolled in college.³

In 1996, 68 research-performing HBCUs contained 2.4 million NASF of S&E research space. Of this space, 29 percent (700,000 NASF) was devoted to biomedical research. Compared to all research-performing academic institutions, HBCUs comprised 12 percent of the nation's research-performing institutions, but only contained 1.8 percent of the nation's 54.6 million NASF of biomedical research space.

HBCUs reported that eight percent of their biomedical research space needed major repair/renovation to be used effectively. Among a panel of 29 institutions that has been sampled consistently since 1988, funding for repairs/renovation increased from \$2 million in fiscal years 1992-1993 to \$6.8 million in the next two fiscal years. In both time periods, only two HBCUs

³ A recent study of science and engineering doctorates revealed that almost 30 percent of black science and engineering doctorate degree recipients between 1985 and 1990 received their degrees from HBCUs.

reported repair/renovation projects of \$100,000 or more. Since the first NSF/NIH survey, new construction funding declined steadily, from \$42 million in 1986- 1987 to \$0.2 million in 1994- 1995. HBCUs received 70 percent of the funding for new construction of biomedical research space from the Federal government.

Laboratory Animal Research Facilities

In 1996, 85 percent of biomedical research-performing institutions maintained laboratory animal facilities. In total, 659 institutions contained 14,030,000 NASF of animal research space. Eighty-two percent of this space fully met government regulations on the humane care of laboratory animals. Nine percent of the space required limited repair/renovation before being able to meet compliance standards, while 8 percent required major repair/renovation. Eighteen percent of the institutions with animal care research space scheduled a total of \$265.7 million of either repair/renovation or new construction projects for laboratory animal facilities for fiscal years 1996 and 1997.

Introduction

Background

Biomedical research facilities are a critical component of the nation's science and engineering (S&E) research system. The availability and condition of biomedical research space directly affect the scope and quality of the biomedical research conducted at the nation's colleges, universities, medical schools, hospitals, and other research organizations. Numerous Congressional committees have expressed concerns about the quality of S&E facilities and the costs of maintaining them. Hearings held in both House and Senate committees on science and technology in the mid-1980s led to the conclusion that the condition of research facilities posed a "serious and ongoing problem. . ."

To address the need for information on the amount and quality of S&E research space, Congress mandated that the National Science Foundation (NSF) gather this information and report it to Congress:

*The National Science Foundation is authorized to design, establish, and maintain a data collection and analysis capability in the Foundation for the purpose of identifying and assessing the research facilities needs of universities and colleges. The needs of universities by **major field** of science and engineering, for construction and modernization of research laboratories, including fixed equipment and major research equipment, shall be documented. University expenditures for the construction and modernization of research facilities, the sources of funds, and other appropriate data shall be collected and analyzed. The Foundation, in conjunction with other appropriate Federal agencies, shall report the results to the Congress. The first report shall be submitted to the Congress by September 1, 1986. (42 U.S.C. 1986)*

Since 1986, NSF and NIH have collected data on a biennial basis to address these concerns of Congress. The first study, a "quick response" survey, provided limited data regarding biomedical facilities issues. In 1988, 1990, 1992, 1994, and 1996, full scale surveys have provided considerable information about the nation's research facilities.

This report describes the findings from the 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities and places them in historical context by comparing results with those from earlier surveys.

The Survey and its Design

The 1996 Survey of Scientific and Engineering Research Facilities at Colleges and Universities, like earlier efforts, collected data on the amount of S&E research space in the nation's higher education institutions, the adequacy and condition of this space, the extent to which universities and colleges were constructing facilities and repairing/renovating space, and the funding of this activity.

Since the survey was initiated in 1986, attention has focused on providing trends on issues related to biomedical research space. Slight changes have been made to the survey, however, in each of the data collection cycles. In 1996, the survey included questions to determine need for additional biomedical research space as well as the need to repair or renovate existing space. The wording of some questions was also modified, as well as possible responses. These changes were made in response to new concerns of NSF, NIH, and Congress, as well as to concerns of institutional respondents and advisory panel members representing the higher education and research communities.

The college/university sample for the 1996 survey represents a universe of approximately 560 institutions. These institutions include all colleges and universities with research and development (R&D) expenditures of \$50,000 or more as well as Historically Black Colleges and Universities (HBCUs) with any R&D expenditures.¹ In addition, a sample of over 200 hospitals and nonprofit research organizations that received extramural research funding for biomedical research from NIH in fiscal year 1992 also were included in the study. The total survey sample represented a universe of 780 institutions with more than \$50,000 in research and development (R&D) as well as HBCUs with any R&D expenditures.

The 1996 survey was mailed to the college and university sample in early fall of 1995 and to the research organizations and hospitals in mid November. Extensive telephone follow-up elicited a high response rate and resolved questions regarding responses. Sampled institutions that participated in the 1994 survey were also sent a computer-generated "facsimile" of their previous responses. Overall, 96 percent of all sampled institutions completed the survey.

¹ The first two cycles of the survey, 1986 and 1988, included only 29 HBCUs. Based on additional information not available when the first two surveys were conducted, the sample for the 1992, 1994, and 1996 studies was expanded to represent an enlarged group of 70 research-performing HBCUs.

The Report

The Status of Biomedical Research Facilities: 1996 focuses on biomedical research facilities — those facilities located in the biological and medical sciences. Biomedical research facilities are not only located at academic institutions, but also are located in hospitals and nonprofit research organizations. This report is one of two major reports presenting findings from the 1988, 1990, 1992, 1994, and 1996 surveys. A companion report produced for Congress by NSF, *Scientific and Engineering Research Facilities at Colleges and Universities: 1996*, presents findings that are limited to academic institutions and do not focus on biomedical research facilities specifically.

The 1996 NIH report follows a similar format to the NSF report with each chapter organized around the following sections:

Highlights, a summary of key findings;

Data Considerations, a presentation of data limitations or interpretations; and

Findings, tables, graphs, and text that address issues pertaining to the state of biomedical research facilities in the United States.

This report provides information similar to that presented in previous reports, particularly data pertaining to trends in the amount, condition, capital activity, and funding of biomedical research space, as well as a profile of HBCUs.

Chapter 1 presents findings on the amount of biomedical research space available in academic and nonacademic settings. Chapter 2 examines the condition and adequacy of biomedical research space as assessed by institutions. Chapter 3 provides information on the costs in constant dollars of constructing facilities and repairing/renovating biomedical research facilities. The sources of funds for these capital projects are presented in Chapter 4. Chapter 5 is new to the NIH report and focuses on deferred construction and repair/renovation in biomedical research facilities. Chapter 6 provides a profile of HBCUs, and Chapter 7 discusses the condition of animal research facilities within biomedical research space.

Interested readers can turn to Appendix A, Technical Notes, for additional material about the study design, methodology, and selected standard errors. Appendix B contains the survey instrument.

Chapter 1

Amount of Research Space

Highlights ...

- Within academic institutions of all types, the biomedical sciences comprised 40 percent, 54.6 million net assignable square feet (NASF), of the total research space assigned to all science and engineering fields.
- In 1996, institutions performing biomedical research devoted a total of 67.4 million NASF to this research. The biological sciences occupied 53 percent of the total biomedical research NASF (35.9 million NASF) and the medical sciences occupied 47 percent of this space (31.5 million NASF).
- Research space in both the biological and medical sciences continued to increase, a pattern evident since 1988, the first year data are available and the National Science Foundation (NSF) and the National Institutes of Health (NIH) began collecting data on biomedical research facilities.
- Slightly over half, 52 percent, of all biological science research space was located in colleges and universities; 56 percent of all medical science research space was located in medical schools.

Data Considerations

The 1996 Survey of Scientific and Engineering Research Facilities collected data on the amount of net assignable square feet (NASF) devoted solely to organized research as well as the NASF assigned to both instruction and research in each major scientific and engineering (S&E) field. Instructional and research NASF includes all space assigned to the fields or the departments within fields, such as departmental and faculty offices, conference and seminar rooms, research space, instructional space, and space leased by institutions. Research NASF is the net assignable square feet devoted exclusively to the research and development activities of an institution that are budgeted and accounted for.

Institutional respondents have indicated that the NASF figures are conservative estimates of the total amount of space used for S&E research. They prorated space that has multiple uses, including S&E research, and did not include space used for undergraduate research or for department-funded faculty research.

Findings

Distribution of Research Space Among Fields and Institutions

In 1996, approximately 780 nongovernmental, noncommercial institutions performed biomedical research, including 539 academic institutions (69 percent), 139 nonprofit research organizations (18 percent) and 102 hospitals (13 percent) (Table I-1). These 780 institutions reported an estimated 67.4 million NASF of biomedical research space in 1996, an increase of 8 percent from 1994 (62.5 million NASF) and an increase of 30 percent from 1988 (51.9 million NASF), the first year the survey was administered.

As in all survey years, institutions reported more assigned research space in 1996 in the biological sciences than in the medical sciences. In this most recent survey period, the 780 institutions involved in biomedical research devoted 35.9 million NASF to biological science research and 31.5 million NASF to medical science research (Table I-2). However, since 1994, the amount of medical science research space increased considerably more than did the amount of biological **science research** space. The total amount of medical science research space increased by 3.1 million NASF in these two years, 11 percent, while the amount of biological science research space increased 1.8 million NASF, or 5 percent.

Table 1-1
Number of institutions and net assignable square feet (NASF) of
biomedical research space, by institution type and control:
1988-1996

[NASF in millions]

INSTITUTION TYPE	Number of institutions, 1996 ¹	BIOMEDICAL RESEARCH SPACE				
		Total				
		1988	1990	1992	1994	1996
Total	780	51.9	55.2	59.7	63.5	67.4
Academic institutions	539	43.3	45.8	50.1	50.7	54.6
Colleges and universities	505	21.4	22.5	23.3	23.0	26.1
Top 50 in research expenditures	49 ²	10.2	10.4	10.7	10.9	12.2
Other doctorate-granting	233	10.0	10.9	11.3	10.6	12.1
Nondoctorate-granting	223	1.1	1.3	1.6	1.0	1.7
Medical schools	134	21.9	23.3	26.8	27.7	28.5
Research organizations	139	4.4	4.8	5.1	6.4	6.6
Hospitals	102	4.2	4.5	4.6	5.4	6.2

¹Entry indicates the estimated number of institutions with assigned research space in the biological and/or medical sciences. Category totals do not sum to grand totals because many institutions contain both a college/university (exclusive of medical school) and a medical school. In grand totals, medical schools are counted as separate institutions only if they are not part of larger universities.

²One of the top 50 research-performing colleges and universities, Baylor College of Medicine, is a medical school and is included in that subtotal.

NOTE: Because of rounding, components may not add to totals.

SOURCE: National Institute of Health, The *Status of Biomedical Research Facilities: 1996*, Bethesda, MD, 1997

Table 1-2
Number of institutions and net assignable square feet (NASF) of
biomedical research space, by institution type and control,
and biomedical field: 1988-1996

[NASF in millions]

INSTITUTION TYPE AND CONTROL	Number of institutions 1996 ¹	BIOMEDICAL RESEARCH SPACE									
		Biological science					Medical science				
		1988	1990	1992	1994	1996	1988	1990	1992	1994	1996
Total	780	28.2	31.0	32.4	34.1	35.9	23.7	24.3	27.3	28.4	31.5
Academic institutions	539	23.9	26.2	27.7	27.9	29.5	19.3	19.8	21.3	22.8	25.1
Colleges and universities	505	16.1	17.6	17.1	17.0	18.7	5.3	5.0	6.2	6.0	7.4
Top 50 in research expenditures	49 ²	7.5	7.6	7.7	7.6	8.1	2.8	2.8	3.0	3.3	4.1
Other doctorate-granting	233	7.6	8.8	8.3	8.0	9.1	2.5	0.1	3.1	2.6	3.0
Nondoctorate-granting	223	1.1	1.2	1.4	0.1	1.45	0.1	0.1	0.1	0.2	.25
Medical schools	134	7.8	8.6	10.6	10.9	10.8	14.0	14.8	16.1	16.8	17.7
Research organizations	139	3.2	3.7	3.7	4.7	4.8	1.3	1.1	1.4	1.7	1.8
Hospitals	102	1.1	1.1	1.0	1.5	1.6	3.1	3.4	3.5	3.9	4.6

¹Entry indicates the estimated number of institutions with assigned research space in the biological and/or medical sciences. Category totals do not sum to grand totals because many institutions contain both a college/university (exclusive of medical school) and a medical school. In grand totals, medical schools are counted as separate institutions only if they are not part of larger universities.

²One of the top 50 research-performing colleges and universities, Baylor College of Medicine, is a medical school and is included in that subtotal.

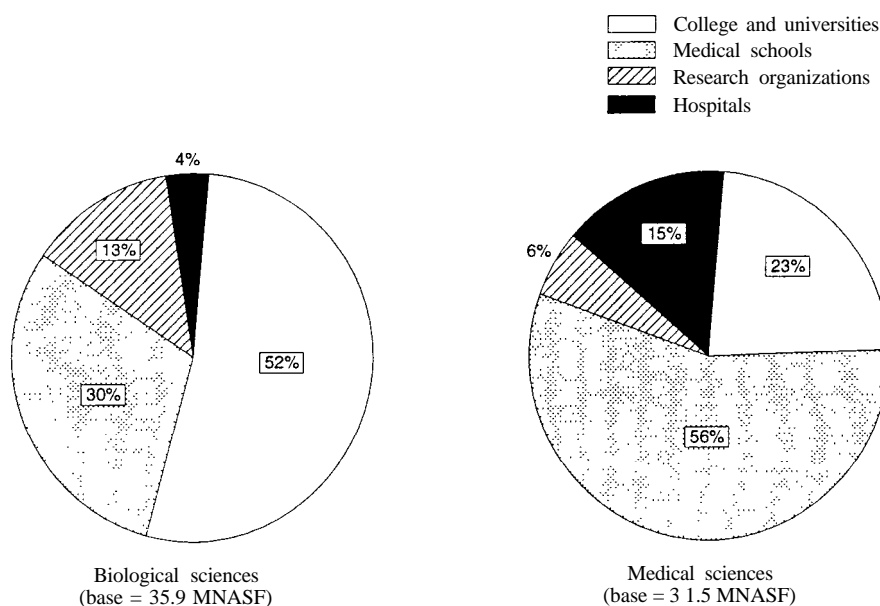
NOTE: Because of rounding, components may not add to totals.

SOURCE: National Institute of Health. *The Status of Biomedical Research Facilities*; 1996. Bethesda, MD, 1997

In 1996, academic institutions contained 81 percent of the total biological and medical sciences research space. Medical schools contained 56 percent of all medical science research space, while colleges and universities (non-medical components) contained 52 percent of all biological research space (Chart 1-I).

Among nonacademic institutions, nonprofit research organizations accounted for a substantial share (13 percent) of biological science research space and hospitals accounted for a comparatively small share (4 percent). Nonprofit research organizations comprised only 6 percent of medical science research space while hospitals accounted for 15 percent (Chart 1-I).

Chart 1-1
Distribution of biomedical research space in
biological and medical sciences,
by type of institution: 1996



KEY: MNASF = Net assignable square feet in millions

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities, 1996*, Bethesda, MD, 1997

Distribution of Research Space Within Academic Institutions

Within academic institutions, the total amount of space assigned to all S&E fields increased between 1994 and 1996, from 282 million NASF to 285 million NASF. The amount of space assigned to S&E fields in 1996 is comparable to that in 1992. The amount of this space assigned to research increased much faster than total space growth, from 127 million NASF in 1994 to 136 million NASF in 1996 (Table 1-3). Whereas the increase in total assigned space to S&E fields represents a 1 percent increase, the increase devoted to research represents a growth of 7 percent.

The total amount of space assigned to the biomedical sciences declined by 1 million NASF between 1994 and 1996, from 112 million NASF to 111 million NASF. This decline occurred solely in non-research space since the amount of space assigned to research increased in the biomedical sciences, from 51 million NASF in 1994 to 55 million in 1996.

Table 1-3
Total assigned space and space assigned for research
at academic institutions, by field: 1988-1996

[NASF in millions]

FIELD	Total assigned space (research and other)					Assigned research space				
	1988	1990	1992	1994	1996	1988	1990	1992	1994	1996
All science/engineering fields	271	276	285	282	285	112	116	122	127	136
Biomedical sciences	111	112	122	112	111	43	46	50	51	55
Biological sciences	45	49	52	52	52	24	26	28	28	29
In universities and colleges	32	34	33	35	36	16	18	17	17	19
In medical schools	13	15	19	17	16	8	9	11	11	11
Medical sciences	66	63	70	60	59	19	20	22	23	25
In universities and colleges	21	22	25	22	23	5	5	6	6	7
In medical schools	45	41	46	38	36	14	15	16	17	18

KEY: NASF = Net assignable square feet

NOTE: Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health. *The Status of Biomedical Research Facilities*: 1996. Bethesda, MD, 1997

The biomedical sciences comprised 39 percent, 111 million NASF, of the total space assigned to all S&E fields. Comparatively, the space assigned to biomedical research comprised 55 million NASF, or 40 percent, of the total space assigned to research in the S&E fields.

Chapter 2

Adequacy and Condition of Research Space

Highlights ...

- Forty-seven percent of all biomedical research institutions classified their biological science research space and 51 percent classified their medical science research space as inadequate, or not sufficient to support the current research commitments.
- Forty-five percent of the biomedical research space at biomedical research institutions was considered to be "... suitable for use in the most scientifically competitive research."
- Seventeen percent (11.5 million NASF) of the biomedical research space at biomedical research institutions was rated as needing either major renovation or replacement to be used effectively.

Data Considerations

The survey measures both the adequacy of the amount of research space and the condition of this space in the biological and medical sciences. Responses to these questions are based on the assessments of a variety of different individuals, including the survey coordinator at the institution, academic deans, and other administrators involved with biomedical facilities. Thus, information about the adequacy of the amount of research space and its condition are potentially more subjective than are other survey responses.

Findings

Adequacy of Research Space

On the surface, it appears that the percentage of biomedical research institutions that rated the amount of research space to be inadequate increased in both the biological and medical sciences between 1994 and 1996, reaching higher percentages than any other survey year. Overall, 47 percent of all institutions with research space in the biological sciences indicated the amount to be inadequate in 1996 whereas two years earlier, 32 percent rated the amount of space this way. The percentage of institutions assessing the amount of research space in the medical sciences to be inadequate increased from 41 percent in 1994 to 51 percent in 1996. However, these findings must be interpreted cautiously (Table 2-1). In earlier years, respondents were provided with three possible choices for rating the adequacy of the amount of available research space — adequate, generally adequate, and inadequate. In 1996, only two categories were provided — adequate and inadequate. It is thus likely that some of those respondents who had in earlier years rated the amount of biomedical research space as “generally adequate” selected “inadequate” when faced with only two options.

With the exception of research organizations, respondents were more likely to indicate inadequate amounts of research space in the medical sciences than in the biological sciences. Perhaps not surprisingly, this was especially the case for medical schools (where 66 percent of the medical schools indicated medical science research space to be inadequate; 46 percent indicated research space in the biological sciences to be inadequate) and hospitals (32 percent rated the amount of medical science research space as inadequate compared to only 14 percent having rated biological science space as such).

Table 2-1
Percentage of institutions reporting inadequate amounts of biomedical research space by institution type and field: 1988-1996

[Percentage of institutions]

INSTITUTION TYPE	Inadequate [*]				
	1988	1990	1992	1994	1996
All institutions:					
Biological sciences	45%	41	32	32	47
Medical sciences	41	44	31	41	51
Colleges and universities:					
Biological sciences	46	43	37	43	53
Medical sciences	40	47	36	43	57
Medical schools:					
Biological sciences	49	54	36	43	46
Medical sciences	47	59	42	49	66
Research organizations:					
Biological sciences	37	14	13	13	32
Medical sciences	23	9	14	29	26
Hospitals:					
Biological sciences	43	30	8	30	14
Medical sciences	44	39	22	42	32

^{*}Includes category "nonexistent but needed."

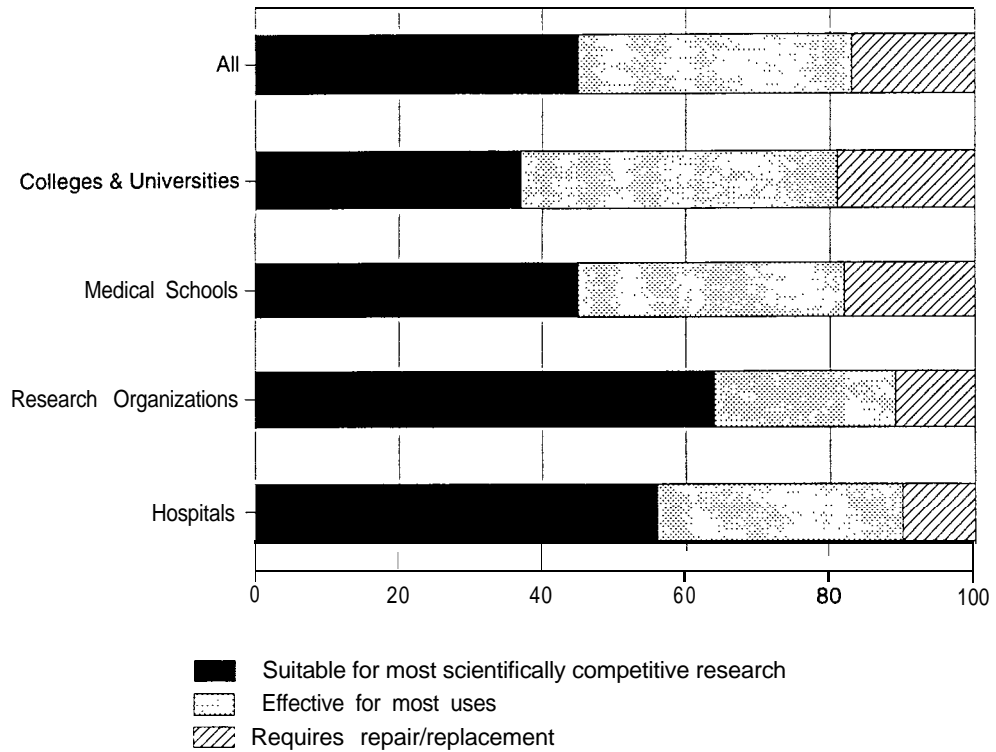
SOURCE: National Institutes of Health. *The Status of Biomedical Facilities*: 1996. Bethesda, MD, 1997

Condition of Research Space

In 1996, 45 percent (30.3 million NASF) of the biomedical research space at all biomedical research institutions was rated as "suitable for the most scientifically competitive research in the field." Another 38 percent (25.6 million NASF) was rated as "effective for most levels of research in the field, but may need limited repair/renovation" and 17 percent (11.5 million NASF) was judged to "require major renovation or replacement to be used effectively" (Table 2-2).

Research organizations rated more of their biomedical research space in the top condition category than colleges and universities, medical schools, and hospitals, with 64 percent of the space considered suitable for the most competitive research. Research organizations and hospitals classified the lowest percentage of biomedical research space as needing major renovation or replacement — 11 percent and 10 percent, respectively.

Chart 2-1
Condition of biomedical research facilities,
by institution type: 1996



SOURCE: National Institutes of Health. *The Status of Biomedical Research Facilities: 1996*, Bethesda, MD; 1997

Table 2-2
Condition of biomedical research facilities,
by institution type: 1996

[Percentage of research NASF]

INSTITUTION TYPE	Suitable for use in most scientifically competitive research	Effective for most levels of research but may need limited repair	Requires major renovation or replacement to be used effectively
All biomedical research institutions	45%	38	17
Colleges and universities, total	37	44	19
Top 50 in research expenditures	43	40	17
Other doctorate-granting	34	46	20
Nondoctorate-granting	26	57	17
Medical schools	45	38	18
Research organizations	64	25	11
Hospitals	56	34	10

KEY: NASF = Net assignable square feet

NOTE: Because of rounding, components may not add to 100.

SOURCE: National Institutes of Health, *The Status of Biomedical Facilities*: 1996. Bethesda, MD, 1997

With the exception of research organizations, institutional differences in the ratings of the condition of research space in the biological and medical sciences tend to be small. Colleges and universities rated 38 percent of their research space in the biological sciences to be suitable for competitive research and 35 percent of the research space in the medical sciences as such. Medical schools rated 45 percent of the biological science research space to be suitable for competitive research and 44 percent of the medical science research space to be in this condition. Hospitals indicated that 57 percent of the biological science research space and 56 percent of the medical science research space was suitable for competitive research. The research organizations, however, rated 67 percent of the biological science research space to be suitable for competitive research and 54 percent of the medical science research space to be in this condition (Table 2-3).

Table 2-3
Condition of biomedical research facilities,
by institution type and field: 1996

[Percentage of research NASF]

INSTITUTION TYPE AND FIELD	Suitable for use in most scientifically competitive research	Effective for most levels of research but may need limited repair	Requires major renovation or replacement to be used effectively
All institutions: Biological sciences Medical sciences	45% 44	39 38	16 18
Colleges and universities: Biological sciences Medical sciences	38 35	44 44	18 21
Medical schools: Biological sciences Medical sciences	45 44	40 36	15 20
Research organizations: Biological sciences Medical sciences	67 54	20 39	13 7
Hospitals: Biological sciences Medical sciences	57 56	30 35	13 9

KEY: NASF = Net assignable square feet

NOTE: Because of rounding, components may not add to 100.

SOURCE: National Institutes of Health. *The Status of Biomedical Facilities: 1996*, Bethesda, MD, 1997

Chapter 3

Construction and Repair/Renovation

Highlights ...

- I In fiscal years 1994-1995, expenditures on projects to construct biomedical research space totaled \$1,521 million. This amount represented a decline of \$723 million in constant dollars (that is, adjusted for inflation) from the two previous fiscal years 1992-1993.
- Expenditures on projects to repair/renovate biomedical research space also declined from fiscal years 1992-1993 levels. In fiscal years 1992-1993, biomedical research institutions spent \$710 million to repair/renovate biomedical research space; in the following two fiscal years, these institutions spent \$674 million, a decline of \$36 million (in constant dollars).
- Colleges and universities were the only type of institution to increase spending to construct new biomedical research space between 1992-1993 and 1994-1995. Similarly, they were the only type of institution to increase spending to repair/renovate biomedical research space across these fiscal years.

Data Considerations

Data reported in this chapter reflect the extent of construction and repair/renovation activity underway in fiscal years 1994-1995. Tables that report expenditures or costs over time are presented in 1995 constant dollars. These “inflation adjusted” dollars compensate for variations in the purchasing power of the dollar over time, using the Bureau of the Census’ Composite Fixed-Weighted Price Index for Construction.

Previous NIH reports also used inflators. The 1994 report adjusted all dollar figures to 1993 dollars using the same index applied in this 1996 report. Earlier reports used the Gross Domestic Product. *Thus, dollar figures presented in this report cannot be compared to **dollar figures** presented in earlier reports.* (See Appendix A, Technical Notes, for further discussion of the price index.)

Throughout this chapter, as well as the rest of the report, the term “capital projects” refers to either construction projects or repair/renovation activities. Construction always refers to building facilities that currently do not exist; repair/renovation implies remodeling or restoring existing facilities.

Findings for construction and repair/renovation projects are limited to those projects with research related costs of \$100,000 or more. All reported costs are estimates of total project costs including planning, construction, and fixed equipment. However, institutions prorated the research-related portion of the cost if the capital project served multiple purposes. In the case of multiyear projects, all project costs were allocated to the fiscal year in which the construction, repair, or renovation actually began.

Findings

Construction Activity

In fiscal years 1994-1995, 109 biomedical research institutions began construction of new biomedical research facilities (Table 3-1). These institutions beginning construction represented 14 percent of all biomedical institutions, a decrease from the 20 percent of institutions starting construction during fiscal years 1992-1993 and the 23 percent in 1990-1991.

Although the numbers of biomedical research institutions starting projects to construct research space declined in each time period since 1988-1989, the drop between fiscal years 1992-1993 and 1994-1995 is notable. In 1992-1993, 151 institutions reported starting construction projects; in 1994-1995, 109 institutions started projects to construct biomedical research space. Colleges and universities and medical schools account for most of this decline.

Table 3-1
Number of institutions starting any projects to construct biomedical research space, by institution type and year of project start: 1986-1997¹

INSTITUTION TYPE	Construction project start year					
	1986 or 1987 [Actual]	1988 or 1989 [Actual]	1990 or 1991 [Actual]	1992 or 1993 [Actual]	1994 or 1995 [Actual]	1996 or 1997 [Planned]
All biomedical research institutions	137	158	150	151	109	110
Colleges and universities	53	94	82	63	50	67
Medical schools	54	46	78	54	34	36
Research organizations	22	18	11	13	11	11
Hospitals	21	10	9	16	22	5

¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only.

NOTE: Category totals do not sum to grand totals because many institutions contain both a college/university (exclusive of medical school) and a medical school. In grand totals, medical schools are counted as separate institutions only if they are not part of larger universities. Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities: 1996*, Bethesda, MD, 1997

During the two year period 1994-1995, expenditures for biomedical research space construction projects totaled \$1,521 million. This amount represented a decrease of \$723 million from the previous two fiscal years. This amount also represented the first decline in constant dollars for construction expenditures since NSF and NIH began collecting data on biomedical research facilities (Table 3-2).

Construction starts for both biological science and medical science research space declined from 1992- 1993. Medical science construction decreased more sharply than biological science construction. Whereas the medical science construction declined from \$1,383 million in 1992-1993 to \$688 million in 1994-1995, biological science construction decreased slightly from \$862 million to \$833 million.

Construction costs for biological science research space exceeded that of medical science research space in 1994-1995. During these two fiscal years, biological science construction accounted for 55 percent of all biomedical construction.

Table 3-2
Net assignable square feet (NASF) of research space to be created and total cost of projects, to construct biomedical research space, by institution type, field, and year of project start: 1986-1997¹

[NASF in thousands; 1995 constant dollars in millions]

INSTITUTION TYPE AND FIELD	CONSTRUCTION PROJECT START YEAR											
	1986 or 1987 [Actual]		1988 or 1989 [Actual]		1990 or 1991 [Actual]		1992 or 1993 [Actual]		1994 or 1995 [Actual]		1996 or 1997 [Planned]	
	NASF	Cost	NASF	Cost	NASF	Cost	NASF	Cost	NASF	Cost	NASF	Cost
Total	4,408	\$1,429	5,817	\$1,753	7,183	\$2,161	7,010	\$2,244	4,261	\$1,521	5,594	\$1,740
Institution type:												
Colleges and universities	1,888	662	1,855	530	2,431	678	1,838	489	1,416	509	2,730	751
Medical schools	1,768	552	2,660	896	3,714	1,167	4,175	1,277	2,272	751	2,514	886
Research organizations	522	146	245	89	547	133	483	195	239	67	208	55
Hospitals	230	69	1,057	237	490	183	513	285	333	194	143	48
Field:												
Biological sciences	2,248	757	2,853	805	3,114	1,033	2,686	862	2,048	833	2,457	769
Medical sciences	2,162	673	2,982	948	4,069	1,127	4,324	1,383	2,213	688	3,137	971

¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only.

NOTE: Because of rounding, components may not add to totals

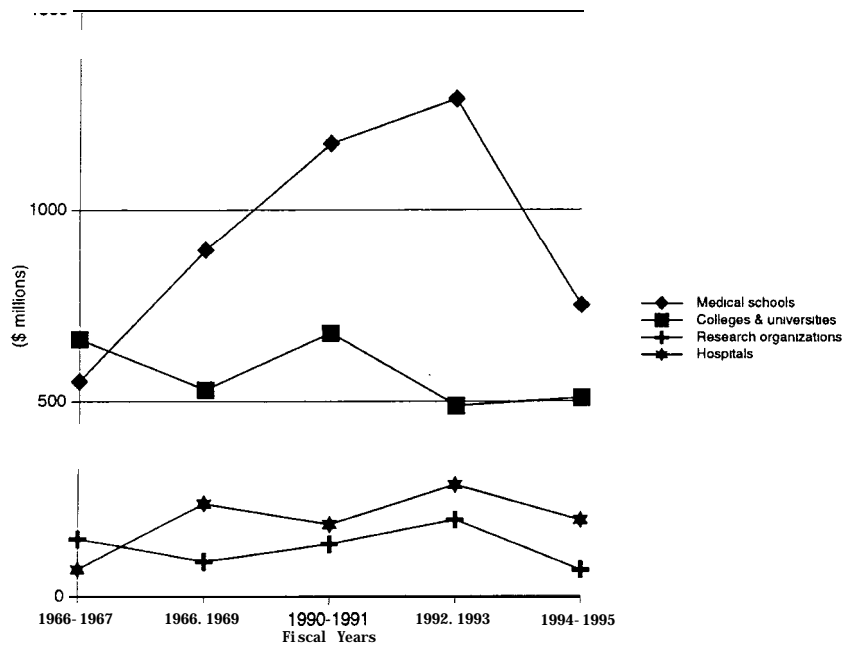
Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Institutes of Health. *The Status of Biomedical Research Facilities*. 1996. Bethesda, MD. 1997

Although medical schools showed a decline in construction costs from 1992-1993, they continued to start the largest amount of biomedical research construction of any type of biomedical research institution. In 1994-1995, medical schools initiated \$751 million of new construction or 49 percent of all biomedical research construction. Despite the drop in the number of colleges and universities beginning biomedical research construction projects between 1992-1993 and 1994-1995 (Table 3-1), the amount of money spent by these institutions increased slightly, from \$489 million to \$509 million across these two fiscal year periods.

Chart 3-1
Amount of biomedical research construction in biomedical
research institutions: 1986-1995¹

[1995 constant dollars in millions]



¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only.

NOTE: Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities: 1996*, Bethesda, MD, 1997

Repair/Renovation Activity

In fiscal years 1994-1995, 231 institutions conducted major projects — involving \$100,000 or more for research components — to repair/renovate existing biomedical research space (Table 3-3). These 231 institutions represented 30 percent of all biomedical research institutions — considerably more than the 14 percent of institutions beginning new construction projects.

Table 3-3
Number of institutions performing major repair/renovation of biomedical research facilities, by institution type and year of project start: 1986-1997¹

INSTITUTION TYPE	REPAIR/RENOVATION PROJECT START YEAR					
	1986 or 1987 [Actual]	1988 or 1989 [Actual]	1990 or 1991 [Actual]	1992 or 1993 [Actual]	1994 or 1995 [Actual]	1996 or 1997 [Planned]
All biomedical research institutions	230	241	255	228	231	208
Colleges and universities	117	132	118	121	126	118
Medical schools	88	76	109	89	86	73
Research organizations	40	34	45	30	36	30
Hospitals	23	39	34	34	28	17

¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only.

NOTE: Category totals do not sum to grand totals because many institutions contain both a college/university (exclusive of medical school) and a medical school. In grand totals, medical schools are counted as separate institutions only if they are not part of larger universities. Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health. *The Status of Biomedical Research Facilities: 1996*. Bethesda, MD. 1997

During the two year period 1994-1995, expenditures for biomedical research space repair/renovation projects totaled \$674 million (Table 3-4). This amount represented a decrease of \$36 million from the previous two fiscal years.

Similar to new construction starts, repair/renovation to medical science research space exceeded that of the biological sciences. In 1994- 1995, medical science repair/renovation accounted for 54 percent or \$367 million of all biomedical repair/renovation projects.

As with new construction, medical schools continued to start the largest amount of biomedical research repair/renovation — performing \$327 million or 49 percent of all repair/renovation in fiscal years 1994- 1995. Similar to construction trends, colleges and universities were the only institution type that increased repair/renovation costs, from \$148 million in 1992-1993 to \$186 million in 1994-95.

Table 3-4
Net assignable square feet (NASF) of space affected and total cost of projects to
repair/renovate biomedical research space, by institution type, field, and
year of project start: 1986-1997¹

[NASF in thousands; 1995 constant dollars in millions]

INSTITUTION TYPE AND FIELD	REPAIR/RENOVATION PROJECT START YEAR											
	1986 or 1987 [Actual]		1988 or 1989 [Actual]		1990 or 1991 [Actual]		1992 or 1993 [Actual]		1994 or 1995 [Actual]		1996 or 1997 [Planned]	
	NASF	cost	NASF	Cost	NASF	Cost	NASF	Cost	NASF	Cost	NASF	cost
Total	7,689	\$658	6,454	\$615	5,486	\$629	5,168	\$710	7,131	\$674	7,811	\$642
Institution type:												
Colleges and universities	3,293	249	2,910	216	1,682	212	1,588	148	2,366	186	2,550	352
Medical schools	3,555	317	2,856	277	2,745	326	2,542	378	3,880	327	4,438	307
Research organizations	415	30	355	35	516	34	268	41	345	31	355	37
Hospitals	427	63	333	87	543	57	770	143	540	130	468	46
Field:												
Biological sciences	3,863	302	3,854	319	2,874	331	2,848	388	2,836	307	3,620	397
Medical sciences	3,826	272	2,600	297	2,612	297	2,320	322	4,295	367	4,190	246

¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only.

NOTE: Because of rounding, components may not add to totals

Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Institutes of Health. *The Status of Biomedical Research Facilities: 1996*. Bethesda, MD. 1997

Chapter 4

Funding of Research Facilities Projects

Highlights ...

- In fiscal years 1994-1995, funding for biomedical research space construction totaled \$1,521 million. The largest proportion, 35 percent, of new biomedical construction was funded by state and local governments. Research organizations relied more heavily on debt financing than other biomedical research facilities, funding 49 percent of new construction this way.
- In fiscal years 1994-1995, biomedical research facilities spent \$674 million to repair/renovate biomedical research space. Institutions used their own funds to finance 46 percent of all repair/renovation projects.

Data Considerations

Institutions reported the amount of money provided by different sources to fund both construction and repair/renovation projects. These data were not collected for individual S&E fields. Estimates of the percentages of funding from various sources for biomedical research capital projects were derived by prorating the distribution of overall S&E funding to the biological and medical sciences.

Institutions reported only on construction and repair/renovation projects that were for research space and that exceeded \$100,000. Within the seven funding categories provided on the survey, considerable diversity is possible. For example, Federal funding can include specific facilities support programs administered by the National Institutes of Health (NIH) or the National Science Foundation (NSF). Federal funding might also include non-peer-reviewed projects that are specified individually through Congressional legislation rather than specific agency programs. There may be some overlap in the categories as well. For example, indirect costs included as institutional funds can come from Federal, state, and local governments.

No information was gathered in the survey that distinguished indirect cost recovery from other institutional funding, such as the use of operating or endowment funds.

In this report, all dollar figures for years prior to 1995 were adjusted using the Bureau of Census' Composite Fixed-Weighted Price Index for Construction. This adjustment means that dollar figures presented in this report do not match the previous reports' figures.

Findings

Funding for Construction Projects

Between the 1992-1993 and 1994-1995 fiscal years, the relative contribution of the Federal government to the construction of biomedical research space declined while the relative contribution of state and local governments increased. In 1994-1995, the Federal government contributed five percent of all construction dollars. This was a decline from both the 1990-1991 and 1992-1993 fiscal years when the Federal government contributed 13 percent of all construction dollars (Table 4-1). Funds from state and local governments represented the largest share of construction dollars in 1994-1995, 35 percent. This share increased from the previous two fiscal years when state and local governments contributed 24 percent of all construction funding for biomedical research facilities (Chart 4-1).

Table 4-1
Sources of funds for construction of biomedical research facilities,
by year of project start and institution type: 1986-1995¹

SOURCE OF FUNDS AND YEAR OF PROJECT START	Institution type				
	Total	Colleges/ universities	Medical schools	Research organizations	Hospitals
[1995 constant dollars in millions]					
Total cost of construction projects:					
1986-1987	\$1,429	662	552	146	69
1988-1989	1,753	531	896	89	237
1990-1991	2,161	678	1,167	133	183
1992-1993	2,244	489	1,277	195	285
1994-1995	1,521	509	751	67	194
[Percentage of total cost]					
Federal Government:					
1986-1987	5%	7	4	3	0
1988-1989	5	7	5	1	0
1990-1991	13	19	11	15	0
1992-1993	13	14	19	7	1
1994-1995	5	4	6	0	0
State/local government:					
1986-1987	26	43	12	10	0
1988-1989	25	42	22	20	0
1990-1991	21	29	22	2	0
1992-1993	24	26	38	0	6
1994-1995	35	49	22	0	0
Private donations:					
1986-1987	36	24	47	53	15
1988-1989	22	24	24	46	0
1990-1991	18	10	18	12	46
1992-1993	13	12	7	22	16
1994-1995	11	9	13	4	17
Debt financing: ²					
1986-1987	14	7	15	23	65
1988-1989	25	22	27	25	29
1990-1991	28	30	2x	46	0
1992-1993	31	23	29	56	43
1994-1995	30	26	36	49	61
Institutional funds:					
1986-1987	17	16	20	9	20
1988-1989	22	5	22	9	61
1990-1991	19	8	20	25	54
1992-1993	16	21	7	15	7
1994-1995	18	11	22	47	22
Other:					
1986-1987	3	5	1	0	0
1988-1989	1	0	0	0	0
1990-1991	1	4	1	0	0
1992-1993	3	4	0	0	27
1994-1995	0	1	0	0	0

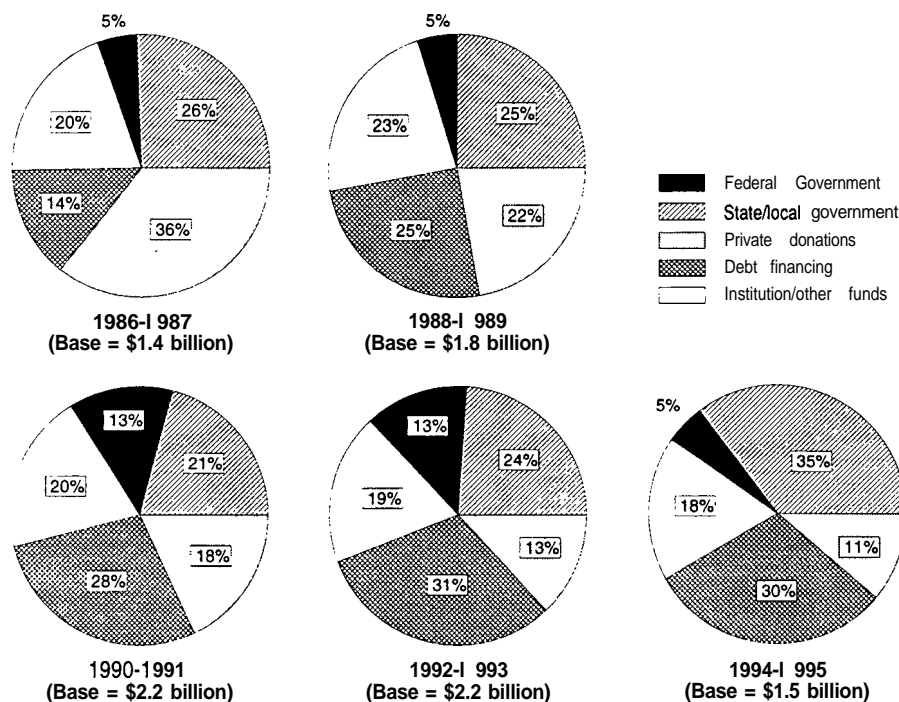
¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only. Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

²Category includes tax-exempt bonds and other debt financing as reported in the questionnaire.

NOTE: Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health. *The Status of Biomedical Research Facilities: 1994*, Bethesda, MD, 1997

Chart 4-1
Sources of funds for construction of
biomedical research facilities: 1986-1995¹



¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only. Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

NOTE: Because of rounding, components may not add to 100.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities*: 1996, Bethesda, MD, 1997

The percentage of dollars to start construction projects that came from tax-exempt bonds and other debt financing increased from 14 percent in 1986-1987 to 31 percent in 1992-1993 and 30 percent in 1994-1995. Debt financing was the dominant source of construction funding for medical schools, research organizations, and hospitals in 1994-1995.

For colleges and universities, state and local governments contributed almost half, 49 percent, of all construction dollars in fiscal years 1994-1995. Debt financing provided another 26 percent of their biomedical research construction funds in fiscal years 1994-1995 and institutional funds contributed 11 percent.

Medical schools used debt financing as the primary source to fund construction in 1994-1995. Thirty-six percent of all their construction dollars were derived from this source. State and local governments and institutional funds each contributed 22 percent.

Both research organizations and hospitals received all of their construction funding from three sources in 1994-1995: private donations, debt financing, and institutional funds. For research organizations, the 1994- 1995 fiscal years were the only ones in which the Federal government provided none of the construction dollars.

Funding for Repair/Renovation Projects

Institutional funds remained the primary source of funding for the repair/renovation of biomedical research space in all types of institutions in fiscal years 1994-1995. These funds accounted for almost half, 46 percent, of all funding for these projects overall (Table 4-2). Institutional funds accounted for 51 percent of repair/renovation funding in medical schools and 39 percent in hospitals.

Overall, private donations represented 15 percent of the repair/renovation funding to biomedical research institutions (Chart 4-2). Hospitals received almost a third, 32 percent, of their repair/renovation funding from this source while research organizations received only 10 percent of their repair/renovation dollars from private donations.

State and local governments contributed 14 percent of the biomedical research repair/renovation dollars in 1994-1995 and debt financing represented 13 percent of these funds. As was the case with the funding of construction, research organizations were more likely to use debt financing to fund repair/renovation than any other type of institution. Research organizations derived 28 percent of all repair/renovation dollars from debt financing.

The Federal government is a relatively small contributor to the repair/renovation of biomedical research space. In fiscal years 1994- 1995, the Federal government provided only 8 percent of all biomedical research repair/renovation dollars.

Table 4-2
Sources of funds for repair/renovation of biomedical research facilities,
by year of project start and institution type: 1986-1995¹

SOURCE OF FUNDS AND YEAR OF PROJECT START	Institution type				
	Total	Colleges/ universities	Medical schools	Research organizations	Hospitals
11995 constant dollars in millions¹					
Total cost of repair/renovation projects:					
1986-1987	\$6.58	249	317	30	63
1988-1989	615	216	277	35	89
1990-1991	629	212	326	34	57
1992-1993	710	148	378	41	143
1994-1995	674	186	327	31	130
	[Percentage of total cost]				
Federal Government:					
1986-1987	4%	3	4	8	2
1988-1989	10	3	8	13	33
1990-1991	5	4	5	19	3
1992-1993	5	6	7	4	2
1994-1995	8	8	7	2	1
State/local government:					
1986-1987	17	25	16	0	0
1988-1989	17	29	16	0	1
1990-1991	20	33	18	0	2
1992-1993	20	25	26		2
1994-1995	14	15	14	7	0
Private donations:					
1986-1987	12	9	12	21	26
1988-1989	8	7	9	30	3
1990-1991	14	16	15	8	6
1992-1993	8	10	9	15	2
1994-1995	15	14	11	10	32
Debt financing: ²					
1986-1987	16	13	20	0	18
1988-1989	12	10	17	0	7
1990-1991	10	2	14	16	8
1992-1993	15	23	7	0	32
1994-1995	13	14	16	28	8
Institutional funds:					
1986-1987	50	49	47	67	54
1988-1989	53	51	50	53	56
1990-1991	51	45	48	57	81
1992-1993	50	35	48	81	62
1994-1995	46	45	51	47	39
Other:					
1986-1987	1	1	1	4	0
1988-1989	0	0	0	4	
1990-1991	0	0	0	0	8
1992-1993	2	1	3	0	0
1994-1995	3	4	0	6	21

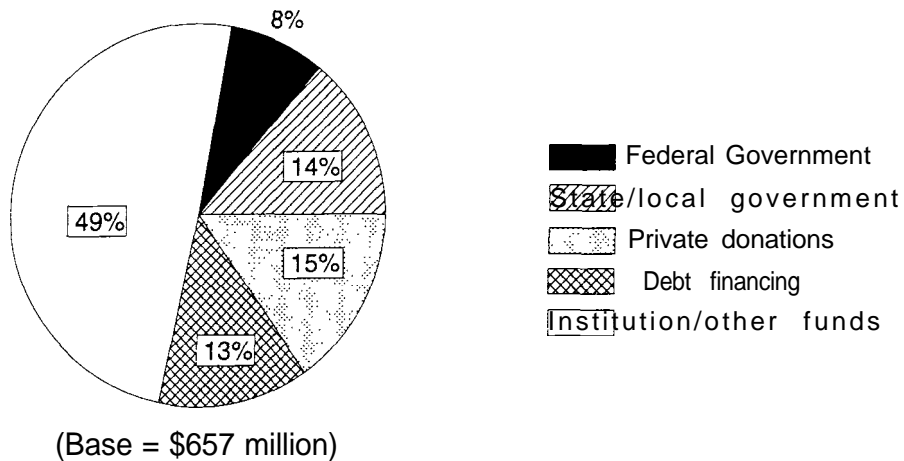
¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only. Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

²Category includes tax-exempt bonds and other debt financing as reported in the questionnaire.

NOTE: Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities: 1994*. Bethesda, MD, 1997

Chart 4-2
Sources of funds for repair/renovation of
biomedical research facilities: 1994-1995¹



¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only. Current dollars have been adjusted to 199.5 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

NOTE: Because of rounding, components may not add to 100.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities: 1994*, Bethesda, MD, 1997

Chapter 5

Deferred Construction and Repair/Renovation

Highlights ...

- In 1996, 36 percent of all institutions with biomedical research space reported capital projects, either construction or repair/renovation, that were needed but had to be deferred because funds were not available.
- The estimated cost for deferred biomedical research construction and repair/renovation projects in 1996 totaled \$4.1 billion. Over three quarters of these deferred capital projects were included in institutional plans.
- The estimated cost for deferred biomedical construction projects totalled \$2.3 billion, or 57 percent of all deferred biomedical capital projects.

Data Considerations

Since its inception in 1988, the *Survey of Scientific and Engineering Research Facilities at Colleges and Universities* has provided considerable data on the amount, condition, and capital project activity in our nation's research-performing institutions. An issue of critical importance to policy makers and an impetus for the legislation mandating the biennial facilities' survey is the desire to determine how much more S&E research space colleges and universities need, as well as to determine the costs of repairing/renovating existing S&E research facilities.

The 1996 survey expanded a question asked for the first time in 1994 to determine construction and repair/renovation costs that institutions had deferred. The earlier effort requested information only about deferred capital projects that were included in an approved institutional plan. In 1996, institutions reported separately the construction and repair/renovation costs for projects included in such plans, as well as for projects not in an approved plan.

Four criteria were used to define deferred projects (see Item 7 of the survey in Appendix B):

- The project must be necessary to meet the current S&E research program commitments;
- The project was not scheduled to begin in fiscal year 1996 or 1997;
- The project was not funded; and
- The project was neither for the purpose of developing new programs nor expanding faculty beyond what is required to fulfill current S&E research program commitments.

These criteria used to define deferred capital projects are intended to limit the notion of need to defined boundaries and to avoid respondents' providing their desires for new or improved space. The term "research program commitment" forces respondents to consider only those research and development (R&D) activities that are budgeted, approved, and funded, which precludes institutions from indicating they need space in a field for which they do not currently have a research program. The boundaries placed upon these definitions of need intentionally produce conservative estimates, rather than unbounded and untested wish lists.

Findings

The Institutional Distribution of Deferred Capital Projects

In 1996, 36 percent of all institutions with biomedical research space reported construction or repair/renovation projects that were needed but had to be deferred because funds were not available. Twenty-five percent of the institutions had included these deferred projects in an approved institutional plan. Fifteen percent of the biomedical research institutions that reported deferred projects also identified projects that were not included in an approved plan.

The total estimated cost for deferred biomedical research construction and repair/renovation projects in 1996 was \$4.1 billion. This total includes both projects that were in institutional plans and those that were not (Table 5-1).

Overall, more than three-quarters of the total deferred capital project expenditures reported by biomedical research institutions (79 percent or \$3.2 billion) were included in institutional plans. Within all types of institutions, the vast majority of deferred capital project expenditures were a part of institutional plans.

Academic institutions accounted for 88 percent of the deferred construction and repair/renovation projects in the biomedical sciences. These institutions accounted for 81 percent of all biomedical research space (See Table 1-1). Nine percent of all deferred capital projects in the biomedical sciences were in the research organizations while only 3 percent of these projects were in hospitals.

Expenditures for deferred construction projects exceeded that for repair/renovation projects. The estimated cost for deferred biomedical research construction projects totalled \$2.3 billion, or 57 percent of all deferred biomedical capital projects. For deferred expenditures included in institutional plans, construction expenditures were generally larger than repair/renovation expenditures (The exceptions were the top 50 institutions in research expenditures and research organizations). For deferred expenditures not included in institutional plans, repair/renovation expenditures were typically greater than construction expenditures (The exceptions were colleges and universities as a whole, the top 50 institutions in research expenditures, and hospitals).

The Distribution of Deferred Capital Projects by Biomedical Field

Deferred capital expenditures for biological sciences research space totalled \$2.055 billion while deferred capital expenditures for medical sciences research space totalled \$2.021 billion. With the exception of biological research space not included in an institutional plan, deferred construction expenditures were larger than deferred repair/renovation expenditures .

Table 5-1
**Expenditures for deferred capital projects to construct or repair/renovate
biomedical research facilities by institution type,
type of project, and whether project was included in institutional plans**

[dollars in millions]

INSTITUTION TYPE	Included in institutional plans		Not included in institutional plans		Total
	To construct new S&E research facilities	To repair/renovate existing S&E research facilities	To construct new S&E research facilities	To repair/renovate existing S&E research facilities	
Total	\$1,901	1,332	415	428	4,076
Academic Institutions	1,703	1,128	382	386	3,599
Colleges and universities	877	622	241	224	1,964
Top 50 in research expenditures	184	269	113	20	586
Other doctorate-granting	608	305	117	140	1,170
Nondoctorate-granting	85	48	11	64	208
Medical schools	826	506	141	162	1,635
Research organizations	149	190	—	32	371
Hospitals	49	14	33	10	106

NOTE: Because of rounding, components may not add to totals

SOURCE: National Institute of Health. *The Status of Biomedical Research Facilities: 1996*. Bethesda, MD, 1997

Table 5-2
Expenditures for deferred capital projects to construct or repair/renovate
biomedical research facilities by field,
type of project, and whether project was included in institutional plans

[dollars in millions]

FIELD	Included in institutional plans		Not included in institutional plans		Total
	To construct new S&E research facilities	To repair/renovate existing S&E research facilities	To construct new S&E research facilities	To repair/renovate existing S&E research facilities	
Biological research space	\$850	743	207	25s	2.055
Medical research space	1,051	589	208	173	2.021

NOTE: Because of rounding, components may not add to totals.

SOURCE: National Institute of Health, *The Status of Biomedical Research Facilities*: 1996, Bethesda, MD, 1997

Chapter 6

Historically Black Colleges and Universities

Highlights ...

- In 1996, the 68 research-performing Historically Black Colleges and Universities (HBCUs) contained 2.4 million net assignable square feet (NASF) of science and engineering (S&E) research space; 29 percent of this space was designated for biomedical research.
- Sixty-seven percent of biomedical research space located in HBCUs was dedicated to the biological sciences and 33 percent was dedicated to the medical sciences.
- Five HBCUs started construction projects, totalling \$685,000 in fiscal years 1994-1995. Repair/renovation projects totalled \$6.9 million in that same time period.

Data Considerations

The National Advisory Committee on Black Higher Education and Black Colleges and Universities identifies 107 higher education institutions that are considered to be Historically Black Colleges and Universities (HBCUs), “institutions established prior to 1964, whose principal mission was, and is, the education of black Americans.” Of this group, 29 reported separately budgeted research expenditures in 1988, the year in which the first full-scale facilities survey was conducted by the National Science Foundation (NSF). All of these institutions were included in the 1988 and subsequent samples. In 1992, NSF identified an additional 41 HBCUs that had separately budgeted research and development (R&D) expenditures. Since 1992, the survey sample included the original panel of 29 institutions and the additional 41 for a total of 70 research-performing HBCUs. As a result, two sets of estimates for HBCUs can be presented — one for the 29 panel institutions and one for all 70 research-performing HBCUs.

Given the relatively small number of HBCUs that have been part of the sample since 1988, fluctuations across time periods can result from a change in one or two institutions.

Findings

Research Facilities in 1996

In 1996, the 68 research-performing HBCUs contained 2.4 million NASF of S&E research space; 700,000 NASF (29 percent) of this space was designated for biomedical research (Table 6-1).

Of the 700,000 NASF of biomedical research space located at HBCUs, 77 percent was dedicated to biological sciences research, with the remainder dedicated to medical sciences research. HBCU biomedical research space was located primarily at HBCU colleges and universities, 67 percent; 33 percent of the space was located at medical schools at HBCUs.’

Slightly over a third, 36 percent, of HBCU biomedical research space was rated as being suitable for use in the most competitive scientific research. This is a little less than the percent rated in **this condition by all academic institutions, 41 percent. HBCUs rated only 8 percent of all** biomedical research space as needing major renovation or replacement; academic institutions rated 18 percent of the biomedical research space in this condition.

‘It should be noted that only three HBCUs had medical schools.

Table 6-1
Amount, condition, and adequacy of research space at Historically Black
Colleges and Universities (HBCUs) in comparison to all
academic institutions: 1996

INDICATOR	HBCUs	All academic institutions
Number of institutions	68	560
Amount of research space (NASF in millions):		
All S&E fields	2.4	136
Biomedical sciences, total	.70	54.6
Colleges and universities	.47	26.1
Biological sciences	.39	18.7
Medical sciences	.08	7.4
Medical schools	.23	28.5
Biological sciences	.15	10.8
Medical sciences	.08	17.7
Condition of existing biomedical research space (percentage of space):		
Total	100%	100%
Suitable for use in the most sophisticated scientific research	36	41
Effective for most uses but not the most sophisticated	55	41
Requires major repair/renovation or replacement to be used effectively	8	18
Adequacy of current amount of biomedical research space (percentage of institutions):		
Total	100%	100%
Sufficient to support needs of current biomedical research program commitments	49	39
Not sufficient to support needs of current biomedical research program commitments	51	61

¹This category includes all academic institutions with any S&E research space. It is not restricted to institutions with biomedical research space.

KEY: NASF = Net assignable square feet
S&E = Science and engineering

NOTE: Because of rounding, components may not add to 100.

SOURCE: National Institutes of Health, *The Status of Biomedical Facilities: 1996*, Bethesda, MD. 1997

Just over half of the HBCUs (51 percent) reported that the current amount of biomedical research space was not sufficient to support the needs of their current biomedical research program commitments.

The 68 research performing HBCUs reported little recent or upcoming activity to expand, upgrade, or maintain their biomedical facilities. Five HBCUs started biomedical research construction projects in fiscal years 1994-1995 (Table 6-2). (Three HBCUs reported construction projects for the 1992-1993 fiscal years.) Three HBCUs started repair/renovation activities in fiscal years 1994-1995, while five were scheduled to start construction and six were scheduled to start repairs in fiscal years 1996-1997.

Table 6-2
Biomedical research facility construction and repair/renovation activity at
Historically Black Colleges and Universities (HBCUs) in comparison
to all academic institutions: 1994-1995¹

INDICATOR	HBCUs	All academic institutions
Number of institutions	68	539
Construction projects, 1994-1995:		
Number of institutions with projects \geq \$100,000	5	109
Expected cost (current dollars in millions)	.685	1,261
Research NASF (in thousands) to be created	7.8	3,689
Sources of funds (percentage of total cost)		
Federal Government	70	4
State/local government	7	49
Private donations	0	9
Institutional funds	23	26
Debt financing	0	11
Other	0	1
Scheduled construction projects, 1996-1997:		
Number of institutions planning projects \geq \$100,000	5	110
Expected cost (current dollars in millions)	22	1,636
Research NASF (in thousands) to be created	75	5,244
Repair/renovation projects, 1994-1995:		
Number of institutions with projects \geq \$100,000	3	231
Expected cost (current dollars in millions)	6.9	513
Research NASF affected (in thousands)	68	6,248
Scheduled repair/renovation projects, 1996-1997:		
Number of institutions planning projects \geq \$100,000	6	208
Expected cost (current dollars in millions)	3.9	559
Research NASF affected (in thousands)	76	6,988

¹Findings are limited to projects with estimated total cost at completion of \$100,000 or more for research space. Estimates are prorated to reflect research components only.

KEY: NASF = Net assignable square feet

SOURCE: National Institutes of Health. *The Status of Biomedical Facilities: 1996*. Bethesda, MD, 1997

In fiscal years 1994-1995, the five HBCUs with biomedical construction projects spent \$685,000. All academic institutions spent \$1.3 billion on biomedical research construction.

A vast majority of the funds to construct new biomedical research space in the HBCUs was provided by the Federal government, 70 percent. Another 23 percent came from institutional funds. The remaining funds came from state and local governments.

Trends in Research Facilities

A panel of 29 HBCUs completed the survey every two years since its first administration in 1988. These 29 institutions include all five of the largest institutions in terms of S&E research expenditures and offer a means to examine capital project trends dating from 1986.

Construction and repair/renovation project starts in the biomedical sciences were markedly down since fiscal years 1986-1987. New construction decreased from eight institutions starting projects in 1986-1987 for \$42 million (in 1995 constant dollars) to one start in 1994-1995 for \$.2 million (Table 6-3).

Likewise, the number of institutions starting repair/renovation projects was down since 1986-1987. In 1994-1995, only two HBCUs started repair/renovation projects versus seven that started them in 1986-1987. However, these two institutions reported spending \$6.8 million for these projects. In 1992-1993, three of the HBCUs indicated spending \$2 million. Thus, the repair/renovation projects to biomedical research space in 1994-1995 appear to be much larger in size than those undertaken in the previous two fiscal years.

Table 6-3
Trends in biomedical research facility construction and repair/renovation activity
at historically black colleges and universities (HBCUs): 1986-1995

INDICATOR	Period of project start				
	1986-1987	1988-1989	1990-1991	1992-1993	1994-1995
Number of institutions*	29	29	29	29	29
Construction projects:					
Number of HBCUs with projects ≥ \$100,000	8	4	2	4	1
Expected cost (dollars in millions)	\$42	\$19	\$13	\$0.6	\$2
Repair/renovation projects:					
Number of HBCUs with projects ≥ \$100,000	7	6	3	3	2
Expected cost (dollars in millions)	\$9	\$10	\$4	\$2	\$6.8

*Estimates refer to the 29 comparatively large HBCUs that were **first** surveyed in 1988.

Findings are limited to projects with estimated total cost at completion of **\$100,000** or more for research space. Estimates are prorated to reflect research components only.

KEY: NASF = Net assignable square feet

NOTE: Because of rounding, components may not add to 100

Current dollars have been adjusted to 1995 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Institutes of Health. *The Status of Biomedical Facilities: 1996*, Bethesda, MD. 1997

Chapter 7

Animal Care Facilities

Highlights ...

- Eighty-five percent of research institutions maintain laboratory animal facilities. In 1996, these 659 facilities contained 14,030,000 NASF of animal research space. Two thirds of this space was used for animal housing and one third was used for animal laboratories.
- Eighty-two percent of the animal care research space fully met government regulations on the humane care of laboratory animals. Of the research space that did not meet compliance, 9 percent required limited repair/renovation, while 8 percent required major repair/renovation.
- Eighteen percent of the institutions with animal care research space (120 institutions) scheduled a total of \$265.7 million of either repair/renovation or new construction projects for laboratory animal facilities for fiscal years 1996 and 1997.

Data Considerations

Biomedical research relies on animals. Federal laws and regulations have been enacted to protect animals used in research and to ensure that the space in which they are kept is adequate (42 U.S.C. 289d and 9 CFR Part 3). Research-performing institutions have indicated that these regulations have placed a significant burden on them. Thus, beginning with the 1992 survey cycle, the facilities' survey included questions to determine the amount of laboratory space dedicated to animal facilities as well as the costs of repairing/renovating these facilities and constructing new ones.

Institutions reported aggregated space estimates for all animal care facilities at the institution and did not provide separate space estimates for each field. Therefore, the analysis does not describe animal care facilities used specifically for biomedical research. It is likely, however, that animal care facilities were largely concentrated in three fields: agricultural sciences, biological sciences, and medical sciences and that the biomedical sciences included a substantial proportion of all animal care facilities.

Findings

Amount of Space

Eighty-five percent, or 659 of the 780 institutions surveyed, contained laboratory animal facilities subject to governmental regulations (Table 7-1). In total, institutions reported 14,030,000 NASF of laboratory animal facilities. Of that space, institutions devoted 66 percent (9,234,000 NASF) to animal housing and 34 percent to animal laboratory space.

Colleges, universities, and medical schools represented 74 percent of the institutions with laboratory animal facilities and accounted for 87 percent of the total animal research space. Research organizations represented 13 percent of the institutions with laboratory animal facilities and occupied 8 percent of all animal research space. Hospitals also represented 13 percent of the institutions with laboratory animal facilities but only occupied 5 percent of the total animal research space.

Public colleges, universities, and medical schools made up 44 percent of the institutions with animal facilities — but contained 68 percent of the total space.] In contrast, private colleges, universities, and medical schools accounted for 31 percent of institutions with animal care facilities but contained only 19 percent of the total animal care NASF space.

There was little difference across types of institutions in the proportions of animal research space devoted to housing and to laboratories.

Table 7-1
Amount and distribution of space for laboratory animal facilities,
by institution type and control: 1996¹

INSTITUTION TYPE	Institutions with laboratory animal facilities		Total animal research space		Animal housing		Animal laboratory	
	Number	Percentage of institutions	Total [NASF in thousands]	Percentage of total animal research space	Total [NASF in thousands]	Percentage of total animal research space	Total [NASF in thousands]	Percentage of total animal research space
Total	659	100%	14,030	100%	9,234	66%	4,796	34%
Colleges, universities, and medical schools ¹	490	74	12,113	87%	8,046	67%	4,167	33%
Public	287	44	9,476	68%	6,188	65%	3,288	35%
Private	203	31	2,738	19%	1,858	68%	879	32%
Research organizations	85	13	1,109	8%	723	65%	386	35%
Hospitals	84	13	707	5%	464	66%	243	34%

¹Figures for academic institutions include all laboratory animal facilities, without regard to field.

KEY: NASF = Net assignable square feet

NOTES: The data refer to institutions reporting any space in laboratory animal facilities that are subject to government regulations concerning the humane care and use of laboratory animals. Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health. *The Status of Biomedical Research Facilities: 1996*, Bethesda, MD, 1997

It is likely that the agricultural sciences account for much of the laboratory animal space in public colleges, universities, and medical schools. Land grant universities are public universities and tend to have agricultural programs.

Condition of Research Space

Institutions report that 82 percent of current animal care research space fully met government regulations in 1996 (Table 7-2). Relatively small amounts of the total research space needed limited repair/renovation or major repair/renovation, 9 percent and 8 percent, respectively. All types of institutions reported high proportions of space meeting full government regulations ranging from 79 percent at public colleges, universities and medical schools to 93 percent at hospitals.

Table 7-2
Percentage of animal care research space meeting government regulations by institution type and control: 1996'

INSTITUTION TYPE	Fully meets government regulations	Needs limited repair/renovation to meet government regulations	Needs major repair/renovation to meet government regulations
Total	82%	9%	8%
Colleges, universities, and medical schools'	82%	10%	9%
Public	79%	10%	11%
Private	91%	7%	2%
Research organizations	85%	11%	4%
Hospitals	93%	5%	1%

'Figures for academic institutions include all laboratory animal facilities, without regard to field

NOTES: The data refer to institutions reporting any space in laboratory animal facilities that **are** subject to government regulations concerning the humane **care** and use of laboratory **animals**. Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities: 1996*. Bethesda, MD, 1997

Repair/Renovation and Construction Scheduled for 1996 and 1997

Eighteen percent of the 659 institutions containing laboratory animal facilities had repair/renovation or construction projects scheduled to start in fiscal years 1996- 1997 (Table 7-3). Research organizations were more likely to undertake laboratory animal capital projects (25 percent) than hospitals (6 percent).

Table 7-3
Number of institutions with scheduled repair/renovation or construction projects on laboratory animal facilities, by institution type and control: 1996¹

INSTITUTION TYPE	Institutions with scheduled projects for 1996		Total cost	
	Number	Percentage of institutions with facilities	Dollars [millions]	Percentage of total cost
Total	120	18%	265.7	100%
Colleges, universities, and medical schools ¹	94	19%	247.4	93%
Public	44	15%	188.4	71%
Private	50	25%	58.9	22%
Research organizations	21	25%	13.7	5%
Hospitals	5	6%	4.5	2%

¹Figures for academic institutions include all laboratory animal facilities, without regard to field.

NOTES: The data refer to institutions reporting any space in laboratory animal facilities that are subject to government regulations concerning the humane care and use of laboratory animals. Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities: 1996*. Bethesda, MD, 1997

The total cost of scheduled capital projects for laboratory animal facilities in fiscal years 1996-1997 was \$265.7 million. Colleges, universities, and medical schools accounted for 93 percent of all scheduled capital projects (\$247.4 million). Research organizations accounted for 5 percent of the scheduled capital projects (\$13.7 million) and hospitals accounted for 2 percent (\$4.5 million).

Institutions with laboratory animal facilities were more likely to have scheduled repair/renovation projects than new construction. Fourteen percent of all institutions with laboratory animal facilities had scheduled repair/renovation projects and six percent had scheduled new construction (Table 7-4). Construction costs, however, exceeded repair/renovation costs. The total estimated cost for scheduled construction was \$174.7 million; the estimated repair/renovation cost was \$91 million.

Similar amounts of NASF were represented by scheduled construction and repair/renovation to animal research facilities. Whereas construction accounted for 695,435 NASF of either new or replaced space, repair/renovation represented 699,476 NASF (Table 7-5). Approximately five percent of all animal research space was scheduled for repair/renovation in 1996.

Table 7-4
**Scheduled construction and repair/renovation for laboratory animal
facility improvement by institutional type: 1996-1997**

INSTITUTION TYPE	Scheduled construction			Scheduled repair/renovation		
	Number of institutions	Percent of institutions	cost fin millions)	Number of institutions	Percent of institutions	cost (in millions)
Total	41	6%	174.7	90	14%	91.0
Colleges, universities, and medical schools	31	6%	164.1	72	15%	83.3
Research organizations	9	11%	8.1	14	16%	5.6
Hospitals	1	1%	2.5	4	5%	2.0

NOTES: The data refer to institutions reporting any space in laboratory animal facilities that are subject to government regulations concerning the humane care and use of laboratory animals. Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health, *The Status Of Biomedical Research Facilities: 1996*, Bethesda, MD, 1997

Table 7-5
NASF scheduled for construction and repair/renovation of laboratory animal facilities by institutional type: 1996-1997

INSTITUTION TYPE	Construction	Repair/renovation
Total	695,435	699,476
Colleges, universities, and medical schools	644,774	531,821
Research organizations	43,055	159,301
Hospitals	7,606	8,354

NOTES: The data refer to institutions reporting any space in laboratory animal facilities that are subject to government regulations concerning the humane care and use of laboratory animals. Because of rounding, components may not add to totals.

SOURCE: National Institutes of Health, *The Status of Biomedical Research Facilities*: 1996. Bethesda, MD, 1997

APPENDIX A

TECHNICAL NOTES

Technical Notes

This appendix discusses the study methodology as well as various other technical aspects that the reader should consider when interpreting the data presented in this report. In addition to the current 1996 survey, the discussion includes the original 1988 survey, and the 1990, 1992 and 1994 surveys. The following topics are covered:

- Universe and sample
- The surveys
- Data collection and response rates
- Item nonresponse
- Weighting
- Reliability of survey estimates
- Data considerations, definitions, and limitations

Universe and Sample

A. Academic Institutions

1988 Survey. The 1988 survey was designed to provide estimates for all research-performing academic institutions, as defined in the National Science Foundation's (NSF) Fiscal Year (FY) 1983 Survey *of Scientific and Engineering Expenditures at Universities and Colleges*. The universe datafile for the 1983 expenditures survey included all universities and colleges that offered a master's or doctorate degree in science and engineering (S&E), all others that reported separately budgeted S&E research and development (R&D) expenditures of \$50,000 or more, and all Historically Black Colleges and Universities (HBCUs) that reported any R&D expenditures. This datafile represented the most recent available universe survey of R&D expenditures at academic institutions. The datafile contained a total of 566 institutions.

All HBCUs in the frame were included in the sample with certainty ($N = 30$), and a stratified probability sample of 223 institutions was selected from among the remaining institutions in the frame. These institutions were first stratified by control (public versus private) and highest degree awarded in S&E (doctorate-granting versus nondoctorate-granting). A minimum sample size of 25 was set for each of the four resulting strata, and the remaining sample was allocated to strata in proportion to the “size” of each stratum. Stratum size was defined as the square root of the aggregate R&D expenditures in S&E of the institutions in the stratum. Academically administered Federally Funded Research and Development Centers were excluded from this survey. Within strata, institutions were sampled with probability proportionate to size. Again, size was defined as the square root of the institution’s fiscal year 1983 R&D expenditures.

Following the selection of an initial sample of 253 institutions, NSF determined that several of the sampled institutions were out of the scope of the survey. Out of scope institutions included those in outlying territories, military academies, and three highly specialized institutions considered inappropriate, given the nature of their programs. Elimination of these out of scope cases reduced the final sample to 247 institutions, of which 29 were HBCUs and 99 had (or were) medical schools.

Institutions in the sample accounted for more than 75 percent of all academic R&D expenditures in fiscal year 1983 and encompassed at least 70 percent of the spending in each major S&E discipline. The sample represented a weighted national total of 525 institutions. The composition of this survey universe, by type of institution, is shown in Table A-1.

Table A-1
Number of institutions in the survey universe of research-performing colleges and universities: weighted estimates, 1988

INSTITUTION TYPE	Total	Non-HBCUs		HBCUs
		Public	Private	
Total	525	296	200	29
Doctorate-granting	293	190	100	3
Top 100 in research expenditures	100	69	31	0
Other	193	121	69	3
Nondoctorate-granting	232	106	100	26

KEY: HBCU = Historically black colleges and universities

SOURCE: National Institute of Health. *The Status of Biomedical Research Facilities: 1996*, Bethesda, MD, 1997

1990 Survey. The institution sample for the 1990 survey was the same as for the 1988 survey, except for the following two changes:

- The sample was updated to reflect recent R&D patterns as shown in NSF's fiscal year 1988 R&D expenditures survey, which collected expenditures data for all institutions in the survey frame for the first time since 1983. School-by-school comparisons of these two databases resulted in the identification of 12 institutions whose 1988 R&D expenditures would have given them substantially higher probabilities of selection than they had using 1983 expenditures. These 12 institutions were made certainty selections for the 1990 survey. Five were already in the sample, having been noncertainty selections in the 1988 study; the other seven were added to the sample for the 1990 survey.
- One institution from the 1988 sample became out of scope when it distributed its assets among other institutions in the same state system. Therefore, this institution was eliminated from the sample.

These same changes noted above produced a net increase of six institutions, increasing the sample size to 253 in 1990. The universe represented by the sample, however, did not change. The sample design for the 1990 survey is summarized in Table A-2.

1992 Survey. The institution universe and sample for the 1992 survey were the same as for the 1990 survey, except for three changes:

- Shortly after the sample for the 1990 facilities survey was selected, NSF conducted a universe survey of all HBCUs and identified an expanded group of 70 that reported separately budgeted R&D expenditures in S&E disciplines. A sample of 46 of these 70 institutions was selected for the 1992 facilities survey, with probability proportionate to size. Size was measured as the square root of the institution's reported 1989 R&D expenditures (a minimum size measure of \$10,000 was used to afford the smallest institutions some possibility of selection).
- The sample was expanded to include all institutions in the top 100 in 1988 R&D expenditures. Only two institutions from this analytically important category were not already in the sample, and they were made certainty selections in 1992.
- To improve the precision of estimates for nondoctorate-granting institutions, an expanded sample of 91 institutions in this category was selected (excluding HBCUs, which were sampled separately). The sample included all (10) public institutions with 1988 R&D expenditures of \$2 million or more, and all (11) private institutions with 1988 expenditures of \$1 million or more. Institutions with R&D expenditures below these cutoffs were sampled with equal selection probabilities.

Of the 91 sampled nondoctorate-granting institutions, nine were later determined to be out of scope, since they reported in the 1992 facilities survey that they had no S&E research space and also reported in the 1988 R&D expenditures survey (which provided the basis for the sampling frame) that they had less than \$50,000 in separately budgeted R&D expenditures. The exclusion of these out of scope institutions reduced the sample of nondoctorate-granting institutions to 82. The sample design for the 1992 survey is summarized in Table A-2.

1994 Survey. The institution universe and sample for the 1994 survey closely matched the 1992 survey, with the following exceptions:

- The 1991 R&D expenditures survey information was used to generate the top 100 stratum. Three institutions were added to the top 100 list, and three institutions were moved out. The expenditures data also were used to calculate the measure of size for the doctorate-granting institutions. The 1988 expenditures survey data were used to calculate size measures for the nondoctorate-granting institutions, since subsequent surveys did not yield complete information for the nondoctorate-granting institutions.
- Institutions expending less than \$50,000 in R&D in S&E fields were removed from the frame prior to sampling. In 1992, they were selected with probability proportionate to size and then excluded after contact.
- FICE codes were updated for 50 institutions.¹
- Six institutions were misclassified with the 1992 sampling list as **nondoctorate-granting**, when in fact they did award S&E doctorates. These misclassifications were corrected.
- Random (rather than systematic) draws from the strata were employed.
- The HBCUs selected with certainty were redefined to include 28 from the 1990 list,² plus all of the new institutions selected with certainty in 1992. This meant that a total of 33 HBCUs was selected with certainty and 12 others were selected with probability proportionate to size.

Of the 314 sampled institutions, five nondoctorate-granting institutions were later determined to be out of scope, since they reported no S&E research space. The exclusion of these out of scope institutions reduced the sample to 309.

¹ This is the Federal Interagency Commission on Education number assigned by the Department of Education. Numbers beginning with 66 are for accredited institutions which have not yet received a FICE number. These are identification numbers for the record file only.

² One of the 29 HBCUs selected with certainty in 1990 was excluded because it had no current funded R&D at the time the sample was taken.

1996 Survey. The institution universe and sample for the 1996 survey were the same as the universe and sample from the 1994 survey. No institutions were added, and none was deleted.

Seven of the nondoctorate-granting institutions in the sample reported no S&E research space in their survey response and were determined to be out of scope. The exclusion of these seven institutions reduced the sample to 307.

The sample design for the 1990, 1992, 1994, and 1996 surveys is summarized in Table A-2. (See Appendix B for a list of 1996 sampled institutions.)

Table A-2
Number of institutions in the 1990, 1992, 1994 and 1996 samples of
research-performing universities and colleges

INSTITUTION TYPE	NON-HBCUs								HBCUs			
	Public				Private							
	1990	1992	1994	1996	1990	1992	1994	1996	1990	1992	1994	1996
Total 138		157	153	156	86	100	93	98	29	46	41	44
Doctorate-granting 1	15	117	113	116	58	58	53	57	3	5	8	10
Top 100 in research expenditures 67	67	69	68	70	31	31	29	30	0	0	0	0
Other 48		48	45	46	27	77	24	27	3	5	8	10
Nondoctorate-granting 23		40	40	40	28	41	40	41	26	41	33	34

(1) The sample initially included nine other institutions that were later classified as out of scope of the study.

KEY: HBCU = Historically black colleges and universities

SOURCE: National Institute of Health. *The Status of Biomedical Research Facilities: 1996*. Bethesda, MD, 1997

B. Research Organizations and Hospitals

In preparation for the 1988 survey, NIH provided listings of all hospitals and nonprofit research organizations that received extramural research funding from NIH during FY 1986. A small number of agencies and institutions that primarily conduct public information dissemination or other nonresearch activities were eliminated from the listings.

Samples of 50 hospitals and 50 research organizations were selected from the listings, with probability proportional to size, as measured by total dollar awards from NIH in FY 1986. It was determined during data collection, however, that there was some duplication in the listings. Some nonprofit research institutions were located within hospitals and shared the same facilities, and some of the research organizations were units within other sampled research organizations. In

addition, some of these institutions have been classified as out of scope of the survey based on their reports that they do not contain any research space (e.g., because their research grants have expired or because their current research is conducted entirely off premises). Elimination of duplicate and out-of-scope institutions has reduced the number of sampled research organizations to 47 and the number of sampled hospitals to 42.

In 1994, an updated list of hospitals and research organizations that received extramural research funding from NIH during FY 1992 provided the sampling frame. Fifty hospitals and 50 research organizations were initially selected. One institution was eliminated from each of these samples either because it was a duplicate or out-of-scope for this study. This resulted in a sample of 49 hospitals and 49 research organizations.

Like the academic institutions' sample, the 1996 sample of hospitals and research organizations was the same as that used in 1994.

The Survey Questionnaire

The 1996 survey questionnaire, reproduced in Appendix B, updated information collected during earlier (1988, 1990, 1992 and 1994) surveys regarding several topics:

- The total net assignable square feet (NASF) of space in science and engineering disciplines, and the NASF used for organized research;
- The total amount of space in all non-science fields, and an overall space total across all academic fields;
- The amount of research space that is leased by the institution;
- The condition of research facilities in each S&E field;
- The adequacy of the current amount of research space, by S&E field;
- The project costs, NASF, and sources of funds for major repair/renovation (\$100,000 or more) and construction activities initiated in fiscal years 1994 and 1995 and scheduled for fiscal year 1996 and 1997;
- Expenditures for research facility repair/renovation projects in the \$5,000 to \$100,000 range;
- The existence of an approved institutional plan that included deferred space requiring repair/renovation or new construction;

- The number of years included in the plan;
- The estimated costs for needed repair/renovations and new construction, by S&E discipline, that the institution was not scheduled to begin during fiscal year 1996 or 1997;
- Scheduled expenditures in fiscal year 1996 or 1997 for construction and repair/renovation of research laboratory animal facilities; and
- The status of the institutions relative to the cap of tax-exempt bonds (applicable only to private universities and colleges).

In addition to collecting updated information on the above topics, the 1996 questionnaire expanded five questions to collect additional information that had not been addressed previously. The additional information included:

- the additional amount of space needed in a discipline if the current amount was reported to be inadequate;
- the amount of space in a discipline that was scheduled to undergo major renovation or replacement if any space in that discipline was reported to require major renovation or replacement;
- the central campus infrastructure costs (\$100,000 or more) scheduled for repair/renovation or new construction in fiscal year 1996 or 1997;
- the central campus infrastructure costs for repair/renovation or new construction that were needed but not funded; and
- the estimated costs not in an institutional plan for needed repair/renovations and new construction, by S&E discipline, that the institution was not scheduled to begin during fiscal year 1996 or 1997.

One new question was added to the 1996 survey that asked for additional comments from the institutions. The optional, open-ended question was designed with two purposes in mind. It allowed the institutions to:

- provide information that numerical data could not capture; and
- help identify new areas of concern relating to S&E research facilities which, in the future, would assist in the development of new survey questions.

Finally, the response categories for two questions were modified slightly in 1996 from previous years' surveys. The questions are about the adequacy of the amount and the condition of S&E research space (see "Data Considerations" later in this appendix for details).

Disk-Based Survey

For the first time since the Facilities Survey began in 1988, institutions had the option in 1996 of responding to the survey either on the printed questionnaire or through a disk-based version of the survey. Institutions were encouraged to utilize the disk version, which contained their 1994 responses. The disk version was programmed to detect logic errors across the 1996 survey items, as well as inconsistencies from the institution's 1994 responses.

Data Collection and Response Rates

In October 1995, a letter from Judith Vaitukatis, Director of the National Center for Research Resources at the National Institutes of Health was sent to the president or director of each sampled institution, asking that the institution participate in the study and that a coordinator be named for the survey. A few days following the two-week deadline for returning the coordinator identification card, telephone follow-up was conducted with all sampled institutions that had not yet identified a survey coordinator. Survey materials, including both a printed survey and DOS-based disk survey, were mailed to the coordinators in mid-November by Federal Express. The questionnaire and cover letter requested return of the completed survey by December 31, 1995. Nonresponse followup began in mid-January and continued through March 1996.

As printed versions of the survey were returned, responses were entered on the disk version to run the series of logic and arithmetic checks. Responses returned on the disk version were available immediately for analysis. Telephone follow-up was conducted with the institutions to resolve data inconsistencies discovered during analysis.

The overall response rate for the NIH-sampled institutions in the 1996 survey was 93 percent. As Table A-3 indicates, response rates were quite high (94 percent or above) for all academic institution categories.

Table A-3
Academic institution response rates, by category
of institution: 1996

INSTITUTION CATEGORY	Number of institutions		Response rate
	Sample ¹	Respondents	
Total	307	298	97
Doctorate-granting	178	173	97
Top 100 in research expenditures	100	100	100
Other	78	73	94
Nondoctorate-granting	85	81	95
Public	161	156	97
Private	102	98	96
HBCUs: Total	44	44	100
Other institutions	98	91	93
Hospitals	49	45	92
Research organizations	49	46	94

¹The sample initially included five other institutions that were later classified as out of scope of the study.

KEY: HBCU = Historically black colleges and universities

SOURCE: National Institute of Health. *The Status of Biomedical Research Facilities: 1996*, Bethesda, MD, 1997

Item Nonresponse

After machine editing of questionnaire responses for completeness, internal consistency, and consistency with data from previous questionnaires, extensive telephone data retrieval was conducted to minimize the amount of missing or otherwise problematic responses to individual questionnaire items. As a result of these persistent follow-up activities, most of the individual items had very low item nonresponse rates.

Missing values were imputed for all questionnaire items that were involved in the data analysis. Missing data on total S&E fields were imputed based on the ratio of total academic space to total space in S&E fields. In Items 2 and 3, reported percentages were converted to NASF based on the amount of research space in Item 1. In Items 4, 6 and 8 (on completed capital projects, planned capital projects, and scheduled animal facility improvement), most missing values involved either missing costs or missing NASF, but not both. In these cases, the missing data element was imputed from the reported element, using 1994 data on average cost per NASF to estimate the one from the other.

Missing values that could not be imputed using the above methods were imputed using a “hot deck” approach. This involved imputing the missing value from a “donor” institution that did provide the needed information and that was as closely matched as possible to the institution with the missing information in terms of control, type (doctorate-granting or nondoctorate-granting) and FY 1994 research expenditures.

Weighting

After data collection, sampling weights were created for use in preparing national estimates from the data. First, within each weight class, a base weight was created for each institution in the sample. The base weight is the inverse of the probability of selecting the institution for the sample. Second, because some institutions in the sample did not respond to the survey, the base weights were adjusted in each weight class to account for this unit nonresponse. Finally, the weights were adjusted again to bring the number of estimated institutions in accordance with the known number of institutions in various categories. For this final “poststratification” adjustment the institutions were classified by type (top 100 in research expenditures, other doctorate-granting, nondoctorate-granting), control, and HBCU status. The poststratified weights were used to produce the estimates shown in this report. The weighting procedures were essentially the same as those employed in the 1988, 1990, 1992 and 1994 studies.

Reliability of Survey Estimates

The findings presented in this report are based on a sample and are therefore subject to sampling variability. Sampling variability arises because not all institutions are included in the study. If a different sample of institutions had been selected, the results might have been somewhat different. The standard error of an estimate is a statistic often used to measure the extent of sampling variability for that particular estimate.

One of the ways that the standard error can be used to measure the amount of sampling variability is in the construction of confidence intervals. If all possible samples were selected and surveyed under similar conditions, then the intervals of 2 standard errors below the estimates to 2 standard errors above the estimates would include the average result of these samples in about 95 percent of the cases. Since only one sample is actually selected and surveyed, we must estimate the standard error from the sample itself. The interval constructed using the estimated standard error from the sample is called a 95 percent confidence interval. Estimated standard errors for selected statistics are shown in Table A-4.

Table A-4
Coefficients of variation for selected estimates from the NSF Survey of
Academic Research Facilities: 1988-1996

ESTIMATE	1988 Survey		1990 Survey		1992 Survey		1994 Survey		1996 Survey	
	Estimate	Coefficient of variation	Estimate	Coefficient of variation	Estimate	Coefficient of variation	Estimate	Coefficient of variation	Estimate	Coefficient of Variation
BIOMEDICAL RESEARCH SQUARE FOOTAGE (in millions)										
All academic institutions	44.0	2.6%	45.9	3.7%	50.1	4.1%	51	3.7%	55	2.3%
Colleges and universities	21.4	3.9	22.5	6.5	23.3	6.5	23	3.9	26	3.0
Medical schools	21.9	5.2	23.3	6.8	26.8	6.2	28	6.0	29	5.6
Research organizations	4.4	10.0	4.8	26.8	5.1	9.0	6	14.9	6.5	5.5
Hospitals	4.2	14.2	4.5	7.1	4.6	1.2	5	10.2	6.2	7.9
ACTUAL REPAIR/RENOVATION COSTS FOR BIOMEDICAL RESEARCH SPACE (in millions of dollars)	(1986+1987)		(1988+1989)		(1990+1991)		(1992+1993)			
All academic institutions	\$450	9.4%	\$422	10.1%	\$477	6.5%	486	7.1%	513	5.7%
Colleges and universities	198	16.7	185	20.0	188	5.6	136	6.4	186	9.3
Medical schools	252	10.0	236	8.5	289	8.3	350	9.3	327	8.8
Research organizations	24	25.0	29	18.2	30	22.0	38	49.4	31	7.9
Hospitals	50	25.6	76	51.6	51	17.8	132	23.3	130	21.5
ACTUAL NEW CONSTRUCTION COSTS FOR BIOMEDICAL RESEARCH SPACE (in millions of dollars)										
All academic institutions	\$968	6.7%	\$1,224	9.2%	\$1,638	3.6%	1,632	9.0%	1,260	9.9%
Colleges and universities	527	10.3	456	11.0	602	3.7	452	11.4	509	22.9
Medical schools	441	6.8	768	12.7	1,036	5.3	1,180	11.6	751	5.2
Research organizations	116	14.3	76	21.1	118	18.1	180	20.7	67	92.8
Hospitals	55	22.9	203	10.7	162	46.8	264	63.0	194	70.2
PLANNED REPAIR/RENOVATION COSTS FOR BIOMEDICAL RESEARCH SPACE (in millions of dollars)	(1988+1989)		(1990+1991)		(1992+1993)		(1994+1995)			
All academic institutions	\$403	4.6%	\$424	5.1%	\$596	5.3%	467	6.7%	560	5.7%
Colleges and universities	175	6.4	156	9.1	150	7.9	185	6.8	252	3.5
Medical schools	228	5.5	268	7.9	446	7.5	282	9.5	308	9.2
Research organizations	40	11.1	39	35.8	41	47.6	51	29.1	37	112.7
Hospitals	77	27.2	32	20.1	39	13.9	63	36.6	46	29.6
PLANNED NEW CONSTRUCTION COSTS FOR BIOMEDICAL RESEARCH SPACE (in millions of dollars)										
All academic institutions	\$1,769	4.4%	\$1,821	11.5%	\$1,776	7.0%	1,489	7.6%	1,637	6.3%
Colleges and universities	551	7.3	669	3.7	541	5.1	454	9.2	751	14.8
Medical schools	1,218	6.7	1,152	17.2	1,235	9.6	1,035	9.2	886	9.6
Research organizations	62	7.0	150	10.7	130	8.8	150	28.9	55	60.7
Hospitals	272	24.9	139	51.0	280	13.0	315	42.3	48	84.7

SOURCE: National Institute of Health, *The Status of Biomedical Research Facilities*, 1996, Bethesda, MD, 1997

The standard errors for this study were estimated using a replication method called the jackknife repeated replication method. Using this method, the sample is divided into 13 replicates, and estimates are produced for each replicate. The variability among these replicate estimates is then used to estimate the standard error.

Data Considerations, Definitions, and Limitations

In addition to sampling errors, survey estimates can be adversely affected by nonsampling errors. Errors of this type include those resulting from reporting and processing of data. In this survey, extensive followup with respondents was used to ensure that the data were as accurate as possible. This included cross-year review that verified inconsistencies between the current and previous questionnaires.

Research Square Footage. In the 1994 survey, research was defined more broadly than in previous years, and this definition was continued in 1996. However, this change in definition has had little effect on how institutions actually reported S&E research space. Like the definition used in previous years, the 1994 definition included all R&D activities that are separately budgeted and accounted for. Unlike the previous definition, the 1994 definition also included departmental research that was not separately budgeted. Conversations with respondents from earlier surveys revealed that some departmental research had been included; thus, the current definition of research reflects what many institutions had been reporting all along.

In 1996, for the first time the survey included a definition of “net assignable square feet” (NASF). NASF was defined as the sum of all areas (in square feet) on all floors assignable to, or available to be assigned to, an occupant for specific use, such as instruction or research. It is unlikely that this inclusion had any effect on trends in this item.

Institutions’ facility recordkeeping systems vary considerably. In general, most of the larger institutions have central computerized facility inventory systems, often based on space surveys conducted specifically for OMB Circular A-21. Many institutions with smaller research programs are not required to calculate square footage for OMB Circular A-21, and do not maintain databases that can provide such information. These institutions had to calculate or estimate square footage information specifically for this study.

Condition and Adequacy of Research Facilities. Questions eliciting assessments of the condition of S&E research space or its adequacy are by their very nature subjective. Two persons **may make different assessments of the same facility or have different opinions of what is required** in order for a facility to be suitable for a particular type of research. Despite the subjectivity involved, these items do capture an overall picture of the current status of facilities.

In 1996, the wording and response choice of the questions assessing both the condition of the institution’s S&E research space and its adequacy were altered slightly from that used in previous years. Respondents were given only three possible choices for evaluating the adequacy of the amount of S&E research space: adequate, inadequate, or not applicable. Five choices had been

provided in 1994. Response possibilities for assessing the current condition of S&E research space were reduced from six choices in 1994 to four in 1996. Thus, percentage changes on these two items must be interpreted with some caution.

Capital Projects Involving Research Facilities. Few institutions maintain information on construction and repair/renovation projects specific to research facilities. Many capital projects involve both research and nonresearch space. When a project was not exclusively for research, institutions had to estimate the proportion of the project that was related to research facilities.

For projects taking more than one year to complete, institutions were asked to allocate the project to the fiscal year in which actual construction activity began or was scheduled to begin.

Because institutions use different dollar values to identify “major projects,” this survey established a guideline to ensure consistency of reporting. As in previous cycles of the survey, projects with costs of \$100,000 or more associated with *research facilities* were included. In 1992, 1994 and 1996, the surveys also had a separate question about costs of repair/renovation projects in the \$5,000 to **\$99,999** range.

Dollar Amounts: Current versus Constant Dollars. In 1994, for the first time, capital project dollar amounts were reported in both constant and current dollars. Both sets of numbers were included in the body of the report but discussion was limited to 1993 constant dollars. The 1996 report also uses both constant and current dollars but the reporting of these two figures differs from the 1994 report.

As in 1994, dollar amounts in 1996 were adjusted using the Bureau of the Census’s Composite Fixed-Weighted Price Index for Construction. Unlike a more general index, this construction index closely tracks inflation within the construction industry. This index reflects only changes in prices and is unaffected by changes in the mix of construction projects during any given year.

Constant dollar tables in the 1996 report cannot be compared to constant dollar tables in the 1994 report.

Specific adjustments used for each of the fiscal years are presented in Table A-5.

Table A-5
Composite fixed-weighted price index for
construction inflation adjustments

Fiscal year	Average composite fixed-weighted price index for construction¹
1986 - 1987	1.253
1988 - 1989	1.166
1990 - 1991	1.126
1992 - 1993	1.081
1994 - 1995	1.000

¹ The index for the second year was used in all calculations that spanned two fiscal years.

SOURCE: *National Institute of Health, The Status Of Biomedical Research Facilities, 1996. Bethesda MD, 1997*

Cost per Square Foot Data. The study did not collect unit cost data for individual construction or repair/renovation projects. It collected only the aggregate research-related costs and the aggregate research space involved across all projects begun during specified periods. These aggregates can be combined into indices of average cost per square foot, which are useful in tracking broad cost trends over time. However, they are of little practical value as guidelines for project planning. By all accounts, unit costs for both construction and repair/renovation projects are highly variable, depending on the specific requirements of the particular project and on many other factors as well (e.g., geographic region of the country). Such differences, which are of crucial importance in project planning, are obscured in the kinds of multiproject averages that can be constructed from this study's data.

Deferred Capital Needs. The 1996 survey added several questions in an effort to derive estimates of the S&E research facilities' needs of research-performing institutions. In 1994, institutions were asked to report on deferred construction and repair/renovation projects that were included in an approved institutional plan. In 1996, institutions reported separately the construction and repair/renovation costs for projects included in such plans, as well as for projects not included. In addition, institutions were asked to report their estimated central campus infrastructure needs, separately for construction and repair/renovation, and for both those in plans and those not in plans. This provided a more complete estimate of deferred capital projects.

In addition to this estimate of research facility needs based on institutions' reports of the S&E research construction and repair/renovation projects that had been deferred, the 1996 survey made additional efforts to measure this need. If institutions indicated that they had an inadequate amount of S&E research space in any given field (Item 2), they were asked to indicate the

additional space needed. Institutions also were asked to report either the amount or percent of that space that was funded and scheduled to undergo major renovation or replacement (Item 3). It was thus possible to derive estimates of the amount of additional space needed and the amount of repair/renovation needed and not scheduled. Average construction and repair/renovation costs per square foot were used to derive another dollar estimate of research facility needs.

Both of these approaches, based on different assumptions, are believed to provide conservative estimates of the research facility needs of research-performing institutions.

Technical Notes

This appendix discusses the study methodology as well as various other technical aspects that the reader should consider when interpreting the data presented in this report. In addition to the current 1996 survey, the discussion includes the original 1988 survey, and the 1990, 1992 and 1994 surveys. The following topics are covered:

- Universe and sample
- The surveys
- Data collection and response rates
- Item nonresponse
- Weighting
- Reliability of survey estimates
- Data considerations, definitions, and limitations

Universe and Sample

A. Academic institutions

1988 Survey. The 1988 survey was designed to provide estimates for all research-performing academic institutions, as defined in the National Science Foundation's (NSF) Fiscal Year (FY) *1983 Survey of Scientific and Engineering Expenditures at Universities and Colleges*. The universe datafile for the 1983 expenditures survey included all universities and colleges that offered a master's or doctorate degree in science and engineering (S&E), all others that reported separately budgeted S&E research and development (R&D) expenditures of \$50,000 or more, and all Historically Black Colleges and Universities (HBCUs) that reported any R&D expenditures. This datafile represented the most recent available universe survey of R&D expenditures at academic institutions. The datafile contained a total of 566 institutions.

All HBCUs in the frame were included in the sample with certainty ($N = 30$), and a stratified probability sample of 223 institutions was selected from among the remaining institutions in the frame. These institutions were first stratified by control (public versus private) and highest degree awarded in S&E (doctorate-granting versus nondoctorate-granting). A minimum sample size of 25 was set for each of the four resulting strata, and the remaining sample was allocated to strata in proportion to the “size” of each stratum. Stratum size was defined as the square root of the aggregate R&D expenditures in S&E of the institutions in the stratum. Academically administered Federally Funded Research and Development Centers were excluded from this survey. Within strata, institutions were sampled with probability proportionate to size. Again, size was defined as the square root of the institution’s fiscal year 1983 R&D expenditures.

Following the selection of an initial sample of 253 institutions, NSF determined that several of the sampled institutions were out of the scope of the survey. Out of scope institutions included those in outlying territories, military academies, and three highly specialized institutions considered inappropriate, given the nature of their programs. Elimination of these out of scope cases reduced the final sample to 247 institutions, of which 29 were HBCUs and 99 had (or were) medical schools.

Institutions in the sample accounted for more than .75 percent of all academic R&D expenditures in fiscal year 1983 and encompassed at least 70 percent of the spending in each major S&E discipline. The sample represented a weighted national total of 525 institutions. The composition of this survey universe, by type of institution, is shown in Table A-1.

Table A-1
Number of institutions in the survey universe of research-performing colleges and universities: weighted estimates, 1988

INSTITUTION TYPE	Total	Non-HBCUs		HBCUs
		Public	Private	
Total	525	296	200	29
Doctorate-granting	293	190	100	3
Top 100 in research expenditures	100	69	31	0
Other	193	121	69	3
Nondoctorate-granting	232	106	100	26

KEY: HBCU = Historically black colleges and universities

SOURCE: National Institute of Health. *The Status of Biomedical Research Facilities: 1996*. Bethesda, MD. 1997

1990 Survey. The institution sample for the 1990 survey was the same as for the 1988 survey, except for the following two changes:

- The sample was updated to reflect recent R&D patterns as shown in NSF's fiscal year 1988 R&D expenditures survey, which collected expenditures data for all institutions in the survey frame for the first time since 1983. School-by-school comparisons of these two databases resulted in the identification of 12 institutions whose 1988 R&D expenditures would have given them substantially higher probabilities of selection than they had using 1983 expenditures. These 12 institutions were made certainty selections for the 1990 survey. Five were already in the sample, having been noncertainty selections in the 1988 study; the other seven were added to the sample for the 1990 survey.
- One institution from the 1988 sample became out of scope when it distributed its assets among other institutions in the same state system. Therefore, this institution was eliminated from the sample.

These same changes noted above produced a net increase of six institutions, increasing the sample size to 253 in 1990. The universe represented by the sample, however, did not change. The sample design for the 1990 survey is summarized in Table A-2.

1992 Survey. The institution universe and sample for the 1992 survey were the same as for the 1990 survey, except for three changes:

- Shortly after the sample for the 1990 facilities survey was selected, NSF conducted a universe survey of all HBCUs and identified an expanded group of 70 that reported separately budgeted R&D expenditures in S&E disciplines. A sample of 46 of these 70 institutions was selected for the 1992 facilities survey, with probability proportionate to size. Size was measured as the square root of the institution's reported 1989 R&D expenditures (a minimum size measure of \$10,000 was used to afford the smallest institutions some possibility of selection).
- The sample was expanded to include all institutions in the top 100 in 1988 R&D expenditures. Only two institutions from this analytically important category were not already in the sample, and they were made certainty selections in 1992.
- To improve the precision of estimates for nondoctorate-granting institutions, an expanded sample of 91 institutions in this category was selected (excluding HBCUs, which were sampled separately). The sample included all (10) public institutions with 1988 R&D expenditures of \$2 million or more, and all (11) private institutions with 1988 expenditures of \$1 million or more. Institutions with R&D expenditures below these cutoffs were sampled with equal selection probabilities.

Of the 91 sampled nondoctorate-granting institutions, nine were later determined to be out of scope, since they reported in the 1992 facilities survey that they had no S&E research space and also reported in the 1988 R&D expenditures survey (which provided the basis for the sampling frame) that they had less than \$50,000 in separately budgeted R&D expenditures. The exclusion of these out of scope institutions reduced the sample of nondoctorate-granting institutions to 82. The sample design for the 1992 survey is summarized in Table A-2.

1994 Survey. The institution universe and sample for the 1994 survey closely matched the 1992 survey, with the following exceptions:

- The 1991 R&D expenditures survey information was used to generate the top 100 stratum. Three institutions were added to the top 100 list, and three institutions were moved out. The expenditures data also were used to calculate the measure of size for the doctorate-granting institutions. The 1988 expenditures survey data were used to calculate size measures for the nondoctorate-granting institutions, since subsequent surveys did not yield complete information for the nondoctorate-granting institutions.
- Institutions expending less than \$50,000 in R&D in S&E fields were removed from the frame prior to sampling. In 1992, they were selected with probability proportionate to size and then excluded after contact.
- FICE codes were updated for 50 institutions.¹
- Six institutions were misclassified with the 1992 sampling list as **nondoctorate-granting**, when in fact they did award S&E doctorates. These misclassifications were corrected.
- Random (rather than systematic) draws from the strata were employed.
- The HBCUs selected with certainty were redefined to include 28 from the 1990 list,² plus all of the new institutions selected with certainty in 1992. This meant that a total of 33 HBCUs was selected with certainty and 12 others were selected with probability proportionate to size.

Of the 314 sampled institutions, five nondoctorate-granting institutions were later determined to be out of scope, since they reported no S&E research space. The exclusion of these out of scope institutions reduced the sample to 309.

¹ This is the Federal Interagency Commission on Education number assigned by the Department of Education. Numbers beginning with 66 are for accredited institutions which have not yet received a FICE number. These are identification numbers for the record file only.

² One of the 29 HBCUs selected with certainty in 1990 was excluded because it had no current funded R&D at the time the sample was taken.

1996 Survey. The institution universe and sample for the 1996 survey were the same as the universe and sample from the 1994 survey. No institutions were added, and none was deleted

Seven of the nondoctorate-granting institutions in the sample reported no S&E research space in their survey response and were determined to be out of scope. The exclusion of these seven institutions reduced the sample to 307.

The sample design for the 1990, 1992, 1994, and 1996 surveys is summarized in Table A-2. (See Appendix B for a list of 1996 sampled institutions.)

Table A-2
Number of institutions in the 1990, 1992, 1994 and 1996 samples of
research-performing universities and colleges

INSTITUTION TYPE	Non-HBCUs								HBCUs					
	Public				Private									
	1990	1992	1994	1996	1990	1992	1994	1996	1990	1992	1994	1996		
Total	138	157			153	156	86	100	93	98	29	46	41	44
Doctorate-granting	1	15												
Top 100 in research expenditures	67	69	68	70	31	31	29	30	0	0	0	0	0	0
Other		4x	45	46	27	77	34	27	3	5	8	10		
Nondoctorate-granting	23		40	40	40	28	42	40	41	26	41	33	34	

(1) The sample initially included nine other institutions that were later classified as out of scope of the study.

KEY: HBCU = Historically black colleges and universities

SOURCE: National Institute of Health. *The Status of Biomedical Research Facilities: 1996*. Bethesda, MD, 1997

B. Research Organizations and Hospitals

In preparation for the 1988 survey, NIH provided listings of all hospitals and nonprofit research organizations that received extramural research funding from NIH during FY 1986. A small number of agencies and institutions that primarily conduct public information dissemination or other nonresearch activities were eliminated from the listings.

Samples of 50 hospitals and 50 research organizations were selected from the listings, with probability proportional to size, as measured by total dollar awards from NIH in FY 1986. It was determined during data collection, however, that there was some duplication in the listings. Some nonprofit research institutions were located within hospitals and shared the same facilities, and some of the research organizations were units within other sampled research organizations. In

addition, some of these institutions have been classified as out of scope of the survey based on their reports that they do not contain any research space (e.g., because their research grants have expired or because their current research is conducted entirely off premises). Elimination of duplicate and out-of-scope institutions has reduced the number of sampled research organizations to 47 and the number of sampled hospitals to 42.

In 1994, an updated list of hospitals and research organizations that received extramural research funding from NIH during FY 1992 provided the sampling frame. Fifty hospitals and 50 research organizations were initially selected. One institution was eliminated from each of these samples either because it was a duplicate or out-of-scope for this study. This resulted in a sample of 49 hospitals and 49 research organizations.

Like the academic institutions' sample, the 1996 sample of hospitals and research organizations was the same as that used in 1994.

The Survey Questionnaire

The 1996 survey questionnaire, reproduced in Appendix B, updated information collected during earlier (1988, 1990, 1992 and 1994) surveys regarding several topics:

- The total net assignable square feet (NASF) of space in science and engineering disciplines, and the NASF used for organized research;
- The total amount of space in all non-science fields, and an overall space total across all academic fields;
- The amount of research space that is leased by the institution;
- The condition of research facilities in each S&E field;
- The adequacy of the current amount of research space, by S&E field;
- The project costs, NASF, and sources of funds for major repair/renovation (\$100,000 or more) and construction activities initiated in fiscal years 1994 and 1995 and scheduled for fiscal year 1996 and 1997;
- Expenditures for research facility repair/renovation projects in the \$5,000 to \$100,000 range;
- The existence of an approved institutional plan that included deferred space requiring repair/renovation or new construction;

- The number of years included in the plan;
- The estimated costs for needed repair/renovations and new construction, by S&E discipline, that the institution was not scheduled to begin during fiscal year 1996 or 1997;
- Scheduled expenditures in fiscal year 1996 or 1997 for construction and repair/renovation of research laboratory animal facilities; and
- The status of the institutions relative to the cap of tax-exempt bonds (applicable only to private universities and colleges).

In addition to collecting updated information on the above topics, the 1996 questionnaire expanded five questions to collect additional information that had not been addressed previously. The additional information included:

- the additional amount of space needed in a discipline if the current amount was reported to be inadequate;
- the amount of space in a discipline that was scheduled to undergo major renovation or replacement if any space in that discipline was reported to require major renovation or replacement;
- the central campus infrastructure costs (\$100,000 or more) scheduled for repair/renovation or new construction in fiscal year 1996 or 1997;
- the central campus infrastructure costs for repair/renovation or new construction that were needed but not funded; and
- the estimated costs not in an institutional plan for needed repair/renovations and new construction, by S&E discipline, that the institution was not scheduled to begin during fiscal year 1996 or 1997.

One new question was added to the 1996 survey that asked for additional comments from the institutions. The optional, open-ended question was designed with two purposes in mind. It allowed the institutions to:

- provide information that numerical data could not capture; and
- help identify new areas of concern relating to S&E research facilities which, in the future, would assist in the development of new survey questions.

Finally, the response categories for two questions were modified slightly in 1996 from previous years' surveys. The questions are about the adequacy of the amount and the condition of S&E research space (see "Data Considerations" later in this appendix for details).

Disk-Based Survey

For the first time since the Facilities Survey began in 1988, institutions had the option in 1996 of responding to the survey either on the printed questionnaire or through a disk-based version of the survey. Institutions were encouraged to utilize the disk version, which contained their 1994 responses. The disk version was programmed to detect logic errors across the 1996 survey items, as well as inconsistencies from the institution's 1994 responses.

Data Collection and Response Rates

In October 1995, a letter from Judith Vaitukatis, Director of the National Center for Research Resources at the National Institutes of Health was sent to the president or director of each sampled institution, asking that the institution participate in the study and that a coordinator be named for the survey. A few days following the two-week deadline for returning the coordinator identification card, telephone follow-up was conducted with all sampled institutions that had not yet identified a survey coordinator. Survey materials, including both a printed survey and DOS-based disk survey, were mailed to the coordinators in mid-November by Federal Express. The questionnaire and cover letter requested return of the completed survey by December 31, 1995. Nonresponse followup began in mid-January and continued through March 1996.

As printed versions of the survey were returned, responses were entered on the disk version to run the series of logic and arithmetic checks. Responses returned on the disk version were available immediately for analysis. Telephone follow-up was conducted with the institutions to resolve data inconsistencies discovered during analysis.

The overall response rate for the NIH-sampled institutions in the 1996 survey was 93 percent. As Table A-3 indicates, response rates were quite high (94 percent or above) for all academic institution categories.

Table A-3
Academic institution response rates, by category
of institution: 1996

INSTITUTION CATEGORY	Number of institutions		Response rate
	Sample ¹	Respondents	
Total	307	298	97
Doctorate-granting	178	173	97
Top 100 in research expenditures	100	100	100
Other	78	73	94
Nondoctorate-granting	85	81	95
Public	161	156	97
Private	102	98	96
HBCUs: Total	44	44	100
Other institutions	98	91	93
Hospitals	49	45	92
Research organizations	49	46	94

¹The sample initially included five other institutions that were interclassified as out of scope of the study

KEY: HBCU=Historically black colleges and universities

SOURCE: National Institute of Health, *The Status of Biomedical Research Facilities: 1996*. Bethesda, MD, 1997

Item Nonresponse

After machine editing of questionnaire responses for completeness, internal consistency, and consistency with data from previous questionnaires, extensive telephone data retrieval was conducted to minimize the amount of missing or otherwise problematic responses to individual questionnaire items. As a result of these persistent follow-up activities, most of the individual items had very low item nonresponse rates.

Missing values were imputed for all questionnaire items that were involved in the data analysis. Missing data on total S&E fields were imputed based on the ratio of total academic space to total space in S&E fields. In Items 2 and 3, reported percentages were converted to NASF based on the amount of research space in Item 1. In Items 4, 6 and 8 (on completed capital projects, planned capital projects, and scheduled animal facility improvement), most missing values involved either missing costs or missing NASF, but not both. In these cases, the missing data element was imputed from the reported element, using 1994 data on average cost per NASF to estimate the one from the other.

Missing values that could not be imputed using the above methods were imputed using a “hot deck” approach. This involved imputing the missing value from a “donor” institution that did provide the needed information and that was as closely matched as possible to the institution with the missing information in terms of control, type (doctorate-granting or nondoctorate-granting) and FY 1994 research expenditures.

Weighting

After data collection, sampling weights were created for use in preparing national estimates from the data. First, within each weight class, a base weight was created for each institution in the sample. The base weight is the inverse of the probability of selecting the institution for the sample. Second, because some institutions in the sample did not respond to the survey, the base weights were adjusted in each weight class to account for this unit nonresponse. Finally, the weights were adjusted again to bring the number of estimated institutions in accordance with the known number of institutions in various categories. For this final “poststratification” adjustment the institutions were classified by type (top 100 in research expenditures, other doctorate-granting, nondoctorate-granting), control, and HBCU status. The poststratified weights were used to produce the estimates shown in this report. The weighting procedures were essentially the same as those employed in the 1988, 1990, 1992 and 1994 studies.

Reliability of Survey Estimates

The findings presented in this report are based on a sample and are therefore subject to sampling variability. Sampling variability arises because not all institutions are included in the study. If a different sample of institutions had been selected, the results might have been somewhat different. The standard error of an estimate is a statistic often used to measure the extent of sampling variability for that particular estimate.

One of the ways that the standard error can be used to measure the amount of sampling variability is in the construction of confidence intervals. If all possible samples were selected and surveyed under similar conditions, then the intervals of 2 standard errors below the estimates to 2 standard errors above the estimates would include the average result of these samples in about 95 percent of the cases. Since only one sample is actually selected and surveyed, we must estimate the standard error from the sample itself. The interval constructed using the estimated standard error from the sample is called a 95 percent confidence interval. Estimated standard errors for selected statistics are shown in Table A-4.

APPENDIX B

SURVEY INSTRUMENT

1996 SURVEY OF SCIENTIFIC AND ENGINEERING RESEARCH FACILITIES AT UNIVERSITIES AND COLLEGES

NATIONAL SCIENCE FOUNDATION (NSF)
NATIONAL INSTITUTES OF HEALTH (NIH)

Acting out of concerns raised by the academic community, Congress directed the National Science Foundation (NSF) to collect and analyze data about research facilities at universities and colleges and to report to Congress every two years. This survey is in response to that requirement under authorization of the National Science Foundation Act of 1950, as amended.

The format of the survey has changed somewhat from the 1994 version, resulting in some additional pages, but in little additional burden to you, the respondent. The main topics in this year's survey are:

- amount of space in your institution;
- amount and condition of research space in your institution;
- costs of capital projects completed, begun, or planned;
- deferred capital projects; and
- miscellaneous topics.

We will use the information that you provide for a report that gives a broad, quantitative picture of

- the cost, availability, and condition of existing science and engineering (S&E) research facilities; and
- the current capital spending by universities and colleges, sources of funding, and plans for future repair/renovation and new construction of S&E research facilities.

The report is used by Congress, many higher education associations, and university and college administrators to help make policy decisions. Your participation in this survey is voluntary. **NSF and NIH do not use or allow other agencies to use the information from this survey to affect individual institutional funding, nor will detailed responses be used in any manner that would identify an individual institution's responses.**

The president or chancellor of your institution named the individual on the label below to coordinate data collection for this survey. Please correct any wrong information on the label.

Label

If someone other than the person listed above coordinates the data collection, please tell us whom we may call if we have questions about the information.

Name	Title/Department	Telephone no. and ext.
------	------------------	------------------------

Completing this survey requires an average of 2-4 hours. If you wish to comment on this burden, contact Herman Fleming, Reports Clearance Officer, NSF, at 703-306-1243, and the Office of Management and Budget, Paperwork Reduction Project (OMB Number 3145-0101), Washington, DC 20503.

Return the completed survey by **December 1, 1995**, to

***The Gallup Organization
Attention: Dr. Jennifer Spielvogel
One Church Street, Suite 900
Rockville, MD 20850***

If you have any questions or comments about the survey, contact Dr. Ann Lanier of NSF at 703-306-1774 or Dr. Jennifer Spielvogel of The Gallup Organization at 1-800-288-9439 (spieja@gallup.com).

GUIDELINES

Refer to these guidelines as you fill out the survey.

1. About this survey-how to use the “Tips” box

With each item in this survey, along with instructions for completing the item, you will find a “Tips” box containing additional information to help you complete the item correctly. The box also contains definitions of terms that appear in the item. Terms appearing in **boldface type** in the instructions are defined in the “Tips” box on that page.

2. The definition of research

In this survey, research is defined as all research activities of your institution that are budgeted and accounted for. Research can be funded by the institution itself, the Federal government, state governments, foundations, corporations, or other sources.

3. What to include as research facilities

In this survey, the term “research facilities” includes

- research laboratories;
- controlled-environment space, such as clean or white rooms;
- technical-support space, such as carpentry and machine shops;
- facilities for laboratory animals, such as animal production colonies, holding rooms, isolation and germ-free rooms;
- faculty or staff offices, to the extent that they are used for research;
- department libraries, to the extent that they are used for research;
- fixed (built-in) equipment, such as fume hoods and benches; and
- non-fixed equipment costing \$1 million or more.

It does not include

- facilities that have been designated as federally funded research and development centers (FFRDC);
- facilities that are used by faculty, but are not administered by the institution, such as research space at Veterans Administration or other non-university hospitals.

4. What fields to include as science and engineering (S&E) fields

Because every institution has its own way of classifying fields of study, for consistency, please use the **Cross Reference** chart (see page **24**) to classify areas of study at your institution. The **Cross Reference** chart identifies the departments that are included within each of the S&E fields used in this survey. The **Cross Reference** chart is based on the classification of academic departments used by the National Center for Educational Statistics. If you are unable to separate data for academic departments, report the combined data under “Other Sciences, not elsewhere classified” and list the fields that those data represent.

For this survey, S&E fields include

- Engineering
- Physical Sciences
- Earth, Atmospheric, and Ocean Sciences (formerly Environmental Sciences)
- Mathematics
- Computer Sciences
- Agricultural Sciences
- Biological Sciences
- Medical Sciences
- Psychology
- Social Sciences
- Other Sciences, not elsewhere classified

They do not include

- law, business administration/management (except economics), humanities, history, the arts, or education (except educational psychology).

5. The definition of net assignable square feet (NASF)

In this survey, NASF is defined as the sum of all areas (in square feet) on all floors of a building assigned to, or available to be assigned to, an occupant for specific use, such as instruction or research. NASF should be measured from the inside faces of walls. Refer to pages 95-96 in Appendix 2 of *Postsecondary Education Facilities Inventory and Classification Manual*. U.S. Department of Education, Office of Educational Research and Improvement, NCES 92-165 (or to the 1988 NACUBO ***Taxonomy of Functions***, or to the 1972 WICHE ***Program Classification Structure***).

6. How to calculate space and cost

Space in NASF

For space used for both S&E research and other purposes: *Prorate* the NASF to reflect the proportion of use for S&E research activity. For example, if a room or building is used for S&E research only during the summer months (one-fourth of the year), then count 25% of the NASF as S&E research space.

For space that is shared by S&E fields: *Prorate* the NASF to reflect the proportion of use by each field. For example, if a room or building is used equally for research activity in Computer Sciences and Mathematics, count 50% of the NASF as research space for Computer Sciences and 50% for Mathematics.

Cost of repair/renovation and new construction

What to include under “completion costs”: Several survey items ask you to report completion costs for repair/renovation and new construction projects. When you report completion costs for projects on S&E research space, include costs for

- planning;
- site preparation; and
- repair/renovation or new construction of
 - the research space itself;
 - fixed equipment;
 - non-fixed equipment costing \$1 million or more; and
 - building infrastructure, such as plumbing, lighting, air exchange, and safety systems in the building and within five feet of the building foundation.

For projects involving both S&E research space and space used for other purposes: Prorate the cost of repair/renovation and new construction projects to reflect the proportion of the space that is used for S&E research. For example, you might construct a new Biological Sciences building at a cost of \$8 million. Half of the space in the new building will be used for biological research and the other half will be used for class instruction. In this case, the prorated cost of construction for S&E research facilities that you should report would be \$4 million, or half of the total cost.

For multi-year projects: Allocate the entire project completion cost to the fiscal year in which the project began or is expected to begin. Consider the start-date for a project to be the date on which repair/renovation or new construction actually began or is expected to begin.

AMOUNT OF SPACE IN YOUR INSTITUTION

Item 1a. Instructional and research space

To complete Item 1a, do the following:

- 1 In Column 1 of the table on the facing page, fill in the current amount of net assignable square feet (NASF) devoted to instruction and **research** for each field listed.
- 2 Near the bottom of Column 1, fill in the current total NASF devoted to instruction and research for
 - science and engineering (S&E) fields (TOTAL #1),
 - non-science fields (TOTAL #2), and
 - all academic fields (TOTAL #3).
- 3 In Column 2, fill in the current amount of **research space** (NASF devoted to research only) for each S&E field listed.
- 4 Near the bottom of Column 2, fill in the total NASF devoted to research in all S&E fields.

Note for institutions using a facilities inventory system based on NCES, NACUBO, or WICHE classifications:

For Column 1 ("Instructional and research NASF"), add the space that is assigned to functional category 1 (Instruction) and category 2 (Research). For Column 2 ("Research NASF"), use only the space that is assigned to functional category 2 (Research). Please refer to pages 95- 96 in Appendix 2 of *Postsecondary Education Facilities Inventory and Classification Manual*, U.S. Department of Education. Office of Educational Research and Improvement. NCES 92- 165 (or to the 1988 NACUBO *Taxonomy of Functions*, or to the 1972 WICHE *Program Classification Structure*).

Tips for completing Item 1a

- Include space leased by your institution.
- Estimate if exact figures are not available.
- If space is used for more than one purpose, prorate the NASF to reflect the proportion of use for the activity the item is asking about. (For an example, see page 3.)
- If space is shared by S&E fields, prorate the NASF to reflect the proportion of use by each field. (For an example, see page 3.)
- Note that the disciplinary field listed as "Environmental Sciences" in prior years' surveys is now listed as 'Earth, Atmospheric, and Ocean Sciences.'
- For help in classifying your programs, refer to the **Cross Reference** chart on page 24.
- Use these definitions for **bolded** items:

NASF: Is the sum of all areas (in square feet) on **all** floors of a building assigned to, or available to be assigned to, an occupant for specific use, such **as** instruction or research. NASF should be measured from the inside faces of walls.

research: Refers to all research activities of an institution that are budgeted and accounted for. Research can be funded by the institution itself, the Federal government, state governments, foundations, corporations, or other sources.

research space: Refers to the NASF of space in facilities within which research activities take place. These **facilities** may include the following (to the extent **that** they are used for research): research laboratories, controlled-environment space, **technical-**support space, facilities for laboratory animals, faculty or staff **offices**, department libraries, fixed equipment (such as fume hoods and benches), and non-fixed equipment costing \$1 million or more.

Table for item 1a. instructional and research space

	Column 1	Column 2
Field	instructional and research NASF	Research NASF
SCIENCE AND ENGINEERING (S&E) FIELDS		
Engineering		
Physical Sciences		
Earth, Atmospheric, and Ocean Sciences (formerly Environmental Sciences)		
Mathematics		
Computer Sciences		
Agricultural Sciences		
Biological Sciences Other than medical school		
Biological Sciences Medical school		
Medical Sciences Other than medical school		
Medical Sciences Medical school		
Psychology		
Social Sciences		
Other Sciences, not elsewhere classified List them:		
TOTAL #1: ALL S&E FIELDS		
TOTAL #2: ALL NON-SCIENCE FIELDS [for example, law, business administration management (except economics), humanities, history, the arts, or education (except educational psychology)]		
TOTAL #3: GRAND TOTAL		

Item 1b. Leased research space

Look at the total research space for all S&E fields (TOTAL #1) in the table above. **How** much of that space is leased?

_____ NASF of leased research space

AMOUNT AND CONDITION OF RESEARCH SPACE

Item 2. Current amount of research space, by field

Item 2 asks you to rate the amount of science and engineering (S&E) **research space** available at your institution. For each field, you will choose one of the following three categories:

- A *Adequate amount of space*: sufficient to support all the needs of your current S&E **research program commitments** in the field
- B *Inadequate amount of space*: not sufficient to support the needs of your current S&E research program commitments in the field; or non-existent but needed
- NA Not applicable or no space needed in the field

To **complete Item 2**, do the following:

- ❶ For each field listed on the table on the facing page, circle the letter of the category in Column 1 that best describes the amount of space available for your current S&E research program commitments in that field.
- ❷ For each field for which you circled B (inadequate amount), estimate and record in Column 2 the additional NASF or percent more space that is needed.

Example 1: The Engineering department's research space is overcrowded to the extent that efficiency of work on an existing grant has been affected. In your answer to Item 3, you should consider the additional space you need to support work on this already awarded grant.

Example 2: The Biology department has made offers to three new faculty needed to support an existing program in molecular biology. In your answer to Item 2, you should consider the space needed to accommodate these new colleagues (even though they are not currently on campus) because it is needed to fulfill already existing program commitments and because offers have been made.

Tips for completing Item 2

- Use these definitions for **bolded** items:

research program commitments: Refers to all research and development activities of an institution that are budgeted, approved, and funded. Research program commitments include

- current *faculty and staff* or those to whom offers have been made;
- *grants* awarded, whether or not research has actually begun; and
- **programs** which have been approved.

They do not include

- potential staff without offers,
- grants applied for but not awarded, and
- programs designed but not yet approved.

research space: Refers to the NASF of space in facilities within which research activities take place. These facilities may include the following (to the extent that they are used for research): research laboratories, controlled-environment space, technical-support space, facilities for laboratory animals, faculty or staff offices, department libraries, fixed equipment (such as fume hoods and benches), and non-fixed equipment costing \$1 million or more.

Table for Item 2. Current amount of research space, by field

Key:

A = Adequate amount of space: sufficient to support all the needs of your current S&E research program commitments in the field

B = Inadequate amount of space: not sufficient to support the needs of your current S&E research program commitments in the field: or non-existent but needed

NA = Not applicable or no space needed in the field

	Column 1			Column 2	
	Adequacy or inadequacy of amount of S&E research space <i>For each field, circle the appropriate code in one of the columns below.</i>			Additional space needed for current S&E research program commitments <i>For each field, you may choose to enter either NASF or percent more space needed. (Enter a figure in one of the columns below for each field.)</i>	
Field	Adequate	Inadequate	Not Applicable	Additional NASF needed	Percent more space needed
Engineering	A	B	NA		
Physical Sciences	A	B	NA		
Earth, Atmospheric, and Ocean Sciences (formerly Environmental Sciences)	A	B	NA		
Mathematics	A	B	NA		
Computer Sciences	A	B	NA		
Agricultural Sciences	A	B	NA		
Biological Sciences Other than medical school	A	B	NA		
Biological Sciences Medical school	A	B	NA		
Medical Sciences Other than medical school	A	B	NA		
Medical Sciences Medical school	A	B	NA		
Psychology	A	B	NA		
Social Sciences	A	B	NA		
Other Sciences, not elsewhere classified List them:	A	B	NA		

Item 3. Current condition of research space, by field

To complete Item 3, do the following:

- 1

For each field listed on the table on the facing page, fill in the percent of **research space** that falls into each category below:
- A

Suitable for the most scientifically competitive research in the field
- B

Effective for most levels of research in the field, but may need limited repair/renovation
- C

Requires **major renovation** or replacement to be used effectively
- NA

Not applicable or no research space in that field
- 2

For each field for which you reported space in category C, record in Column 3 the number of NASF or percent of that space that is funded and scheduled to undergo major renovation or replacement in your FY 1996 or FY 1997.

Tips for completing Item 3

- >

Consider only space supporting your *current* S&E research **program** commitments.
- >

Use these definitions for **bolded** items:

major renovation: Refers to an extensive repair project that results in facilities that are equivalent, or nearly equivalent, to new facilities in their ability to support S&E research.

research space: Refers to the NASF of space in facilities within which research activities take place. These facilities may include the following (to the extent that they are used for research): research laboratories, controlled-environment space, technical-support space, facilities for laboratory animals, faculty or staff offices, department libraries, **fixed** equipment (such as fume hoods and benches), and non-fixed equipment costing \$1 million or more.

Table for Item 3. Current condition of research space, by field

Key:

A = Suitable for the most *scientifically* competitive research in the field

B= Effective for most levels of research in the field, but may need limited repair/renovation
(Includes categories B and C from 1994 survey)

c = Requires major renovation or replacement to be used effectively
(Includes categories D and E from 1993 survey)

NA = Not applicable or no research space in this field

Field	Column 1					Column 2	
	Percent of research space according to condition					Amount of space in category C that is funded and scheduled to undergo major renovation or replacement in your FY 1996 or FY 1997	
	A	B	C	Total	NA	NASF	Percent of space
Engineering				100%			
Physical Sciences				100%			
Earth, Atmospheric, and Ocean Sciences (formerly Environmental Sciences)				100%			
Mathematics				100%			
Computer Sciences				100%			
Agricultural Sciences				100%			
Biological Sciences Other than medical school				100%			
Biological Sciences Medical school				100%			
Medical Sciences Other than medical school				100%			
Medical Sciences Medical school				100%			
Psychology				100%			
Social Sciences				100%			
Other Sciences, not elsewhere classified List them:				100%			

COSTS OF CAPITAL PROJECTS COMPLETED, BEGUN, OR PLANNED

Item 4a. Research facilities projects over \$100,000: your FY 1994 and FY 1995

This item asks you to report the completion costs (planning, preparation, construction, fixed equipment, non-fixed equipment costing \$1 million or more, building infrastructure) and net assignable square feet (NASF) involved in repair/renovation and new construction of science and engineering (S&E) research facilities.

To complete Item 4a, do the following:

- 1. In Columns 1 and 3 of the table on the facing page, for each field listed, fill in the completion costs for repair/renovation and new construction projects over \$100,000, and in the row marked TOTAL, fill in the total completion costs for repair/renovation and new construction.
- 2. In Columns 2 and 4 of the table on the facing page, for each field listed, fill in the estimated NASF involved in repair/renovation and new construction projects over \$100,000, and in the row marked TOTAL, fill in the estimated total NASF for repair/renovation and new construction.

Tips for completing Item 4a

- Consider only projects that began during your FY 1994 or FY 1995. (Consider the start-date for a project to be the date on which repair/renovation or new construction actually began.)
- If space is shared by S&E fields, prorate the NASF and cost to reflect the proportion of use by each field. (For an example, see page 3.)
- Consider only projects whose prorated cost in a given field is over \$100,000. (All the dollar figures in Column 1 or Column 3 of the table on the facing page should be over \$100,000.)
- Use these definitions for **bolded** items:
 - building infrastructure: Includes systems that exist in the building and within five feet of the building foundation, such as plumbing, lighting, air exchange, and safety systems.
 - fixed equipment: Refers to equipment that is built into facilities, such as fume hoods and lab benches.
 - NASF:** Is the sum of **all** areas (in square feet) on all floors of a building assigned to, or available to be assigned to, an occupant for specific use, such as instruction or research. NASF should be measured from the inside faces of walls.
 - new construction:** Refers to additions to an existing building or construction of a new building.
 - repair/renovation: Refers to the **fixing Up** of facilities in deteriorated condition, capital improvements on facilities, conversion of facilities, etc.

Table for Item 4a. Research facilities projects over \$100,000: your FY 1994 and FY 1995

Field	REPAIR/RENOVATION over \$100,000 begun during your FY 1994 or FY 1995		NEW CONSTRUCTION over \$100,000 begun during your FY 1994 or FY 1995	
	Column 1 cost	Column 2 NASF	Column 3 cost	Column 4 NASF
Engineering				
Physical Sciences				
Earth, Atmospheric, and Ocean Sciences (formerly Environmental Sciences)				
Mathematics				
Computer Sciences				
Agricultural Sciences				
Biological Sciences Other than medical school				
Biological Sciences Medical school				
Medical Sciences Other than medical school				
Medical Sciences Medical school				
Psychology				
Social Sciences				
Other Sciences, not elsewhere classified List them:				
TOTAL				

Item 4b. Research facilities projects between \$5,000 and \$100,000: your FY 1994 and FY 1995

To *complete* Item 4b. do the following:

In the blank below, fill in the total dollar amount for completion costs of repair/renovation projects between \$5,000 and \$ 100,000 begun in your FY 1994 and FY **1995**.

Total for repair/renovation projects (costing between \$5,000 and \$100,000 each) of your science and engineering (S&E) research facilities \$ _____

Tips for completing Item 4b

- Consider only projects that began during your FY 1994 or FY 1995. (Consider the start-date for a project to be the date on which repair/renovation or new construction actually began.)
- Include projects to repair/renovate fixed equipment, non-fixed equipment costing \$1 million or more, and building infrastructure.
- Exclude projects whose prorated cost is less than \$5,000 or more than \$100,000.
- Use these definitions for **bolded** items:

building infrastructure: Includes systems that exist in the building and within five feet of the building foundation, such as plumbing, lighting, air exchange, and safety systems.

fixed equipment: Refers to equipment that is built into facilities, such as fume hoods and lab benches.

repair/renovation: Refers to the **fixing** up of facilities in deteriorated condition, capital improvements on facilities, conversion of facilities, etc.

Go to the next page.

Item 5. Sources of funding for research facilities projects: your FY 1994 and FY 1995

To complete Item 5, do the following:

- In the row marked TOTAL on the table on the facing page, at the bottom of Columns 1 and 2, copy the cost totals for your science and engineering (S&E) research facilities projects from Item 4a, Columns 1 and 3:
 - **repair/renovation** projects costing over \$ 100,000, and
 - **new construction** projects costing over \$100,000.
- Fill in the dollar amounts of funding from each source listed.

Tips for completing Item 5

- Consider only projects that began during your FY 1994 or FY 1995. (Consider the start-date for a project to be the date on which repair/renovation or new construction actually began.)
- Note that “Institutional funds” include operating funds, endowments, indirect costs recovered from federal grants and/or contracts, indirect costs recovered from other sources, etc.
- Use these definitions for **bolded** items:
 - new construction:** Refers to additions to an existing building or construction of a new building.
 - repair/renovation:** Refers to the **fixing up** of facilities in deteriorated condition, capital improvements on facilities, conversion of facilities, etc.

Table for Item 5. Sources of funding for research facilities projects: your FY 1994 and FY 1995

	Column 1 Dollar amount for REPAIR/RENOVATION projects costing over \$100,000	Column 2 Dollar amount for NEW CONSTRUCTION projects costing over \$100,000
Federal government		
State or local government		
Private donations		
Institutional funds (Operating funds, endowments, indirect costs recovered from federal grants and/or contracts, indirect costs recovered from other sources, etc.)		
Tax-exempt bonds		
Other debt financing		
Other sources List them:		
TOTAL	I	

Item 6. Planned research facilities projects over \$100,000 scheduled to begin in your FY 1996 and FY 1997

To complete Item 6, do the following:

- ❶ In Columns 1 and 3 of the table on the facing page,
 - for each field listed, fill in the completion costs for projects over \$100,000 (planning, site preparation, construction, fixed equipment, non-fixed equipment costing \$1 million or more, building infrastructure) for planned projects (both repair/renovation and new construction), and
 - in the row marked TOTAL #1, fill in the total completion costs for all science and engineering (S&E) fields.
- ❷ In Columns 2 and 4.
 - for each field listed, estimate the net assignable square feet (NASF) involved in those projects (*Note: be sure to include here any space that you reported in Column 2 of the table for Item 3*), and
 - in the row marked TOTAL #1, fill in the estimated NASF for all S&E fields.
- ❸ Near the bottom of the table, in the row marked TOTAL #2, enter the estimated completion costs for planned capital projects to extend, repair, or renovate central campus infrastructure.
- ❹ Add the figures in the row marked TOTAL #1 to those in the row marked TOTAL #2. Record the total figures in the row marked TOTAL #3.

Tips for completing Item 6

- Consider only projects scheduled to begin during your FY 1996 or FY 1997.
- If space is shared by S&E fields, prorate the NASF and cost to reflect the proportion of use by each field. (For an **example**, see page 3.)
- Include only projects whose prorated cost in a given field is over \$100,000. (All the dollar figures in Column 1 or Column 3 of the table on the facing page should be **over \$100,000**.)
- Estimate if exact figures are not available.
- Use these definitions for **bolded** items:

building infrastructure: Includes systems that exist in the building and within five feet of the building foundation, such as plumbing, lighting, air exchange, and safety systems.

central campus infrastructure: Refers primarily to systems that exist between the buildings of a campus (excluding the area within five feet of any individual building foundation) and to the nonarchitectural elements of campus design (central wiring for telecommunications systems, storage/disposal facilities, electrical wiring between buildings, central heating and air exchange systems, drains and sewers, roadways, walkways, parking systems, etc.)

fixed equipment: Refers to equipment that is built into facilities, such as fume hoods and lab benches.

NASF: Is the sum of **all** areas (in square feet) on all floors of a building assigned to, or available to be assigned to, an occupant for specific use, such as instruction or research. NASF should be measured from the inside faces of walls.

new construction: Refers to additions to an existing building or construction of a new building.

planned project: Refers to a project that is funded and scheduled but on which construction has not yet begun.

repair/renovation: Refers to the fixing up of facilities in deteriorated condition, capital improvements on facilities, conversion of facilities, etc.

Table for Item 6. Planned research facilities projects over \$100,000 scheduled to begin in your FY 1996 and FY 1997

Field	REPAIR/RENOVATION over \$100,000 scheduled to begin in your FY 1996 or FY 1997		NEW CONSTRUCTION over \$100,000 scheduled to begin in your FY 1996 or FY 1997	
	Column 1 Expected Cost	Column 2 Estimated NASF	Column 3 Expected Cost	Column 4 Estimated NASF
Engineering				
Physical Sciences				
Earth, Atmospheric, and Ocean Sciences (formerly Environmental Sciences)				
Mathematics				
Computer Sciences				
Agricultural Sciences				
Biological Sciences Other than medical school				
Biological Sciences Medical school				
Medical Sciences Other than medical school				
Medical Sciences Medical school				
Psychology				
Social Sciences				
Other Sciences, not elsewhere classified List them:				
TOTAL #1: ALL S&E FIELDS				
TOTAL #2: CENTRAL CAMPUS INFRASTRUCTURE (Includes telecommunications, electrical systems, plumbing systems, steam and chilled water lines, hazardous materials systems, etc.)				
TOTAL #3: GRAND TOTAL				

DEFERRED CAPITAL PROJECTS

Item 7. Costs for repair/renovation and new construction of research space needed but not funded

To complete Item 7, do the following:

- 0 Read the definition in the “Tips” box to the right for **deferred project**. According to this definition, does your institution have any deferred projects for **repair/renovation or new construction** of your science and engineering (S&E) research facilities?

☐ Yes. Go to step 2.

☐ No. Go to Item 8 (see page 20).

- 2 Read the definition in the “Tips” box to the right for **institutional plan**. Then,

- for deferred projects that are *part of an institutional plan*, enter the estimated completion costs (planning, site preparation, construction, **fixed equipment**, non-fixed equipment costing \$1 million or more, **building infrastructure**) in Columns 1 and 2 of the table on the facing page; and
- for deferred projects that are *not* part of an institutional plan, enter the estimated completion costs in Columns 3 and 4.

- 3 Record the totals for these estimates in the row marked TOTAL #1

- 4 Near the bottom of the table, in the row marked TOTAL #2, enter the estimated completion costs for deferred capital projects to extend, repair, or renovate **central campus infrastructure**—both those **that are, and** those that are not, part of an institutional plan.

- 5 Add the figures in the row marked TOTAL #1 to those in the row marked TOTAL #2. Record the total figures in the row marked TOTAL #3.

Tips for completing Item 7

- If space is shared by S&E fields, prorate the cost to reflect the proportion of use by each field. (For an example, see page 3.)
- For help in **classifying** your programs, refer to the **Cross Reference chart** on page 24.
- Use **these** definitions for **bolded** items:

building infrastructure: Includes systems that exist in the building and within five feet of the building foundation, such as plumbing, lighting, air exchange, and safety systems.

central campus infrastructure: Refers primarily to systems **that** exist between the buildings of a campus (excluding the area within five feet of any individual building foundation) and to the nonarchitectural elements of campus design (central wiring for telecommunications systems, storage/disposal facilities, electrical wiring between buildings, central heating and air exchange systems, drains and sewers, roadways, walkways, parking systems, etc.)

deferred project: Refers to a repair/renovation or new construction project which meets all of the following criteria:

- is necessary to meet your current S&E research program commitments,
- is not scheduled for your FY 1996 or **FY 1997**,
- does not have funding, and
- is neither for the purpose of developing new programs nor for expanding faculty beyond what is required to **fulfill** current S&E research program commitments.

fixed equipment: Refers to equipment that is built into facilities, such as fume hoods and lab benches.

institutional plan: Refers to an institution’s approved plan, including goals, **strategies**, steps, and budgets, for fulfilling the institution’s mission during a specific time period.

new construction: Refers to **additions** to an existing building or construction of a new building.

repair/renovation: Refers to the **fixing up of facilities** in deteriorated condition, capital improvements on facilities, conversion of facilities, etc.

Table for Item 7. Costs for repair/renovation and new construction of research space needed but not funded

*Note: If you cannot provide cost estimates, **you may** instead record estimated NASF for deferred projects (prorate if necessary). If you choose to do this and are recording NASF rather than dollars in the table below, check (✓) here: ☐*

Field	Estimated cost for deferred projects needed for current S&E research program commitments			
	Needs INCLUDED in an institutional plan		Needs NOT INCLUDED in an institutional plan	
	Column 1	Column 2	Column 3	Column 4
	Repair/renovation costs	New construction costs	Repair/renovation costs	New construction costs
Engineering				
Physical Sciences				
Earth, Atmospheric, and Ocean Sciences (formerly Environmental Sciences)				
Mathematics				
Computer Sciences				
Agricultural Sciences				
Biological Sciences Other than medical school				
Biological Sciences Medical school				
Medical Sciences Other than medical school				
Medical Sciences Medical school				
Psychology				
Social Sciences				
Other Sciences, not elsewhere classified List them:				
TOTAL #1: ALL S&E FIELDS				
TOTAL #2: CENTRAL CAMPUS INFRASTRUCTURE (Includes telecom- munications, electrical systems, plumbing systems, steam and chilled water lines, hazardous materials systems, etc.)				
TOTAL #3: GRAND TOTAL				

MISCELLANEOUS ITEMS

Item 8. Facilities for laboratory animals

To complete Item 8, answer the following:

- ❶ Does your institution have facilities for laboratory animals?

☐ No. Go to Item 9 on the next page.

☐ Yes. Go to step ❷.

- ❷ Below, fill in the amounts of your **animal housing NASF** and **animal laboratory NASF**. Add the two figures to arrive at your total animal research **NASF**.

+	Animal housing NASF	_____
	Animal laboratory NASF	_____
=	Total animal research NASF	_____

- ❸ Fill in the amounts of your total animal research NASF that

- fully meets government regulations _____ NASF
- needs limited repair/renovation to meet government regulations _____ NASF
- needs major repair/renovation or replacement to meet government regulations _____ NASF

The total of the three categories above should equal the total animal research NASF in ❷.

- ❹ Fill in the costs and amounts of NASF for animal facility improvements involving

- repair/renovation over \$100,000 scheduled to begin in your FY 1996 or FY 1997
cost _____ NASF _____
- new construction over \$100,000 scheduled to begin in your FY 1996 or FY 1997
cost _____ NASF _____

Note: Be sure to also include in your answer to Item 6 on page 17 any projects you include in your answer to ❹ above.

Tips for completing Item 8

- Include as **laboratory** animal facilities both departmental and central facilities that are subject to government and state policies and regulations concerning humane care and use of laboratory animals.
- Do not include in your lab animal facilities space :
 - agricultural field buildings sheltering animals that do not directly support research or that are not subject to government regulations concerning humane care and use of laboratory animals; or
 - areas for treatment of animals that are veterinary patients.
- Use these definitions for **bolded** items:

animal housing NASF: Refers to all general animal housing (for example, cage rooms, stalls, wards, isolation rooms) and maintenance areas (for example, feed storage rooms, cage-washing rooms, shops, storage), if these areas directly support research. (Animal housing NASF are Codes 570 and 575 in the *Postsecondary Education Facilities Inventory and Classification Manual*.)

animal laboratory NASF: Refers to **all** animal laboratory space used exclusively for research activities, such as bench space, animal production colonies, holding rooms, germ-free rooms, surgical facilities and recovery rooms.

total animal research NASF: Refers to the combined amount of animal laboratory and animal housing NASF. (Total animal research NASF is equivalent to the term 'Research NASF' in Item #10 of the 1994 survey.)

Item 9. Limit on tax-exempt bonds

To complete Item 9, answer the following questions:

- ❶ Is your institution a private college or university?
- ☐ No. Go to Item 10 on the next page.
- ☐ Yes. Go to step ❷.
- ❷ Federal tax reform legislation established a limit on tax-exempt bonds of \$150 million per private college or university.
- Has your institution reached the limit on tax-exempt bonds?
- ☐ Yes.
- ☐ No, but we expect to within the next two fiscal years.
- ☐ No, and we do not expect to within the next two fiscal years.

Item 10. Additional comments

This is an optional, open-ended question designed with two purposes in mind. It allows you to

- give us information which numerical data cannot capture, and
- help us identify new areas of concern relating to science and engineering (S&E) research facilities. Such discoveries may, in future surveys, warrant further quantitative investigation.

To complete Item 10, write any additional comments you may have in the space below:

Item 11. Feedback

We appreciate the time you have taken to fill out the 1996 *survey*.

How many person-hours were required to complete this form? _____

Return the survey by *December 1, 1995*, to

*The Gallup Organization
Attention: Dr. Jennifer Spielvogel
One Church Street, Suite 900
Rockville, MD 20850*

CROSS REFERENCE BETWEEN NSF FIELD CATEGORIES AND THE NCES CLASSIFICATION OF ACADEMIC DEPARTMENTS

Use this chart to identify the departments that are included within each of the Science and engineering (S&E) fields used in this survey.

ENGINEERING

- 101 Aerospace Engineering
 - 14.02 Aerospace, aeronautical, and astronautical engineering
- 102 Agricultural Engineering
 - 14.03 Agncultural engineering
- 103 Biomedical Engineering
 - 14.05 Bioengineering and biomedical engneermg
- 104 Chemical Engineering
 - 03.0509 Wood sciences
 - 14.07 Chemical engineering
- 105 Civil Engineering
 - 04.02 Architecture
 - 14.04 Architectural engineering
 - 74.08 Civil engineering
 - 14.14 Environmental health engineering
- 106 Electrical Engineering
 - 14.09 Computer engineering
 - 14.10 Electrical, electronics, and communicahons engineering
 - 11.1002 Microelectronic engineering
- 107 Engineering Science
 - 71.12 Engineering physics
 - 14.13 Engineering science
- 108 Industrial Engineering/Management Science
 - 14.17 Industrial engineering
 - 11.27 Systems engineering
 - 30.06 Systems science
- 109 Mechanical Engineering
 - 14.11 Engineering mechanics
 - 14.19 Mechanical engineering
- 110 Metallurgical and Materials Engineering
 - 14.06 Ceramic engineering
 - 14.18 Materials engineering
 - 11.20 Metallurgical engineering
 - 40.0701 Metallurgy
- 111 Mining Engineering
 - 11.15 Geological cngneermg
 - 14.16 Geophysical engineering
 - 11.21 Mining and mineral engineering
- 112 Nuclear Engineering
 - 11.23 Nuclear engineering
- 113 Petroleum Engineering
 - 11.25 Petroleum engineering
- 114 Engineering, not elsewhere classihed
 - 14.01 Engineering, general
 - 14.22 Naval architecture and marine engineering
 - 14.24 Ocean engineering
 - 14.28 Textile engineering
 - 14.99 Engineering, other
 - 19.09 Textiles and clothing (excluding 19.0902, Fashion Design)
 - 30.03 Engineering and other fields

PHYSICAL SCIENCES

- 201 Astronomy
 - 40.02 Astronomy
 - 40.03 Astrophysics
 - 40.09 Planetary science
- 202 Chemistry
 - 40.05 Chemistry
- 203 Physics
 - 40.08 Physics
- 204 Physical Sciences, not elsewhere classified
 - 40.01 Physical sciences, general
 - 40.0799 Miscellaneous physical sciences, other
 - 40.099 Physical sciences, other

EARTH, ATMOSPHERIC, AND OCEAN SCIENCES

- 301 Atmospheric Sciences
 - 40.4 Atmospheric sciences and meteorology
- 302 Geosciences
 - 40.06 Geological and related sciences
 - 40.0703 Earth and planetary sciences
- 303 Ocean Sciences
 - 26.0607 Marine/aquatic biology
 - 40.0702 Oceanography
- 304 Earth, Atmospheric, and Ocean Sciences, N.E.C.

MATHEMATICS

- 402 Mathematics and Applied Mathemahcs
 - 06.1302 Operations research (quantitative methods)
 - 27.01 hlatemahcs, general
 - 27.03 Applied mathematics
 - 27.04 Pure mathematics
 - 27.99 hlatemahcs, other
 - 30.08 Mathemahcs and computer science
- 403 Stahshcs
 - 27.02 Actuarial sciences
 - 27.05 Statistics

COMPUTER SCIENCES

- 401 Computer Sciences
 - 06.12 Management mformation systems
 - 11 Computer and mformahon sciences, general
 - 30.09 Imaging science

AGRICULTURAL SCIENCES (SEE ALSO 102 AND 901)

- 501 Agricultural Sciences
 - 02.01 Agncultural sciences, general
 - 02.02 Animal sciences
 - 02.03 Food sciences
 - 02.04 Plant sciences
 - 02.05 Soil sciences
 - 02.99 Agricultural sciences, other
 - 03.01 Renewable natural resources, general

- 03.03 Fishing and fisheries
- 03.05 Forestry and related sciences
- 03.06 Wildlife management
- 03.99 Renewable natural resources, other
- 31.04 Water resources

BIOLOGICAL SCIENCES

- 601 Anatomy
 - 18.0201 Clinical anatomy
 - 26.0601 Anatomy
- 602 Biochemistry
 - 18.0202 Clinical biochemistry
 - 26.02 Biochemistry and biophysics
- 603 Biology
 - 26.01 Biology, general
 - 26.0601 Embryology
- 601 Biometry and epidemiology
 - 18.2202 Epidemiology
 - 26.0602 Biometrics and biostatistics
- 605 Biophysics
- 606 Botany
 - 26.03 Botany (excluding 26.0302, Bacteriology; see 611)
- 607 Cell Biology
 - 26.01 Cell and molecular biology
 - 26.0606 Histology
- 608 Ecology
 - 26.0603 Ecology
- 609 Entomology and Parasitology
 - 26.0610 Parasitology
 - 26.07102 Entomology
- 610 Genetics
 - 26.0703 Genetics, human and animal
- 611 Microbiology, immunology, and Virology
 - 18.0203 Clinical microbiology
 - 18.1002 Allergies and endomology
 - 18.1009 Immunology
 - 26.0302 Bacteriology
 - 26.05 Microbiology
- 612 Nutrition
 - 19.05 Food sciences and human nutrition
 - 20.0108 Food and nutrition
 - 26.0609 Nutritional sciences
- 613 Pathology
 - 18.0204 Clinical pathology
 - 18.1018 Pathology
 - 26.0704 Pathology, human and animal
- 614 Pharmacology
 - 18.0206 Clinical toxicology
 - 26.0612 Toxicology
 - 26.0705 Pharmacology, human and animal
 - 42.14 Psychopharmacology
- 615 Physiology
 - 18.0205 Physiology
 - 26.0706 Physiology, human and animal
- 616 Zoology
 - 26.0701 Zoology
 - 26.0799 Zoology, other
- 617 Biosciences, not elsewhere classified
 - 26.0699 Miscellaneous specialized areas, life sciences, other
 - 26.99 Life sciences, other

MEDICAL SCIENCES (see also 103)

- 701 Anesthesiology
 - 18.1003 Anesthesiology
- 702 Cardiology
- 703 Cancer Research / Oncology
- 704 Endocrinology
 - 26.0605 Endocrinology
- 705 Gastroenterology
- 706 Hematology
 - 18.08 Hematology
- 707 Neurology
 - 18.102-1 Neurology
 - 26.0608 Neurosciences
- 708 Obstetrics and Gynecology
 - 18.1013 Obstetrics and gynecology
- 709 Ophthalmology
 - 18.1011 Ophthalmology
 - 18.12 Optometry
- 710 Otorhinolaryngology
 - 18.1017 Otorhinolaryngology / otolaryngology
- 711 Pediatrics
 - 18.1019 Pediatrics
 - 20.0102 Child development
- 712 Preventive Medicine and Community Health
 - 18.1007 Family practice
 - 18.1022 Preventive medicine
- 713 Psychiatry
 - 18.1023 Psychiatry
 - 18.1106 Psychiatry/mental health
- 714 Pulmonary Disease
- 715 Radiology
 - 18.1012 Nuclear medicine
 - 18.1025 Radiology
 - 26.0611 Radiobiology
- 716 Surgery
 - 18.1001 Colon and rectal surgery
 - 18.1011 Neurological surgery
 - 18.1016 Orthopedic
 - 18.1021 Plastic surgery
 - 18.1026 Surgery
 - 18.1027 Thoracic surgery
- 717 Clinical Medicine, not elsewhere classified
 - 18.0299 Basic clinical health sciences, other
 - 18.1001 Medicine, general
 - 18.1005 Dermatology
 - 18.1008 Geriatrics
 - 18.1010 Internal medicine
 - 18.1020 Physical medicine and rehabilitation
 - 18.1028 Urology
 - 1X.7099 Medicine, other
 - 18.13 Osteopathic medicine
 - 18.15 Podiatry
 - 30.01 Biological and physical sciences
- 718 Dental Sciences
 - 18.01 Dentistry
 - 18.1015 Orthodontic surgery
- 719 Nursing
 - 18.11 Nursing (excluding 18.1106, Psychiatry/mental health; see 713)

- 720 **Pharmaceutical Sciences**
18.14 Pharmacy
- 721 **Veterinary Sciences**
18.24 Veterinary medicine
- 722 Health Related, not elsewhere classified
17.0807 Occupational therapy
17.0813 Physical therapy
17.0899 Rehabilitation services, other
17.99 Allied health, other
18.07 Health **sciences** administration
18.09 Medical laboratory
18.22 Public health
18.99 Health sciences, other
- 723 Speech Pathology and Audiology
18.01 Audiology and speech pathology

PSYCHOLOGY

- 801 Psychology
13.08 School psychology (not including Educational Psychology)
- 17.0801 Art therapy
- 42 Psychology (including Educational Psychology)

SOCIAL SCIENCES

- 901 Agricultural Economics
01.0102 Agricultural business and management
01.0103 Agricultural economics
- 902 Anthropology (Cultural and Social)
45.02 Anthropology
45.03 Archeology
- 903 Economics (except **Agricultural**)
06.05 Business Economics
45.06 Economics
- 904 Geography
45.07 Geography
- 905 History and philosophy of science
- 906 Linguistics
23.06 Linguistics
42.13 Psycholinguistics
- 907 Political Science
44.01 Public affairs, general
44.03 International public service
44.04 Public administration
44.05 Public policy studies
44.99 Public affairs, other
15.09 International affairs
45.10 Political science and government
- 908 Sociology
45.05 Demography
45.11 Sociology
- 909 Sociology and Anthropology
- 910 Social Sciences, not elsewhere classified
04.03 City, community, and regional **planning**
05 Area and ethnic studies
06.06 Human resources development
06.15 **Organizational** behavior
31.03 Parks and recreational management
43.01 **Criminal justice**
44.02 **Community** services
44.07 Social work
45.01 Social sciences, general
45.04 Criminology
45.12 Urban studies
45.99 Social sciences, other

3542.2

**The Status of Biomedical Research
Facilities 1996.**

